



FRONTIERS OF THE ROMAN EMPIRE – THE LOWER GERMAN LINES

NOMINATION FILE FOR INSCRIPTION ON THE UNESCO WORLD HERITAGE LIST

PART I – NOMINATION FILE



2 Description

The nominated property *Frontiers of the Roman Empire – The Lower German Limes* represents the boundary of one of the north-western provinces of the Roman Empire (c. 27 BC – AD 480 in the West). It is located in a dynamic riverine landscape, which is responsible for several distinctive characteristics of the military infrastructure, and for the outstanding and rare preservation of organic remains, especially timber constructions.

This chapter offers a description of the nominated property, outlining its distinctive attributes and values (section 2.a) and its history and development, both during and after the Roman period (section 2.b). Since the Lower German Limes is only a part of the frontiers of the Roman Empire, both its description and its history are set out against the background of the whole of the Roman frontiers, and of their potential as World Heritage.

When linked but spatially separated parts of a larger entity could not be included within a single boundary, the separate parts have been nominated as individual component parts. In such cases these associated component parts have been grouped in clusters and presented under a joint heading. This explains the use of the term ‘component parts/clusters’ throughout this nomination dossier. Notations such as ‘Neuss-Koennenlager ►33’ refer to the catalogue of component parts (Annex 1), where the component part/cluster in question can be found under the number indicated in blue.

2.a Description of property

The description of the nominated property has been divided into five sections. The first is a very succinct sketch of the frontiers of the Roman Empire as World Heritage (section 2.a.1), referring to the existing World Heritage site *Frontiers of the Roman Empire* (Ref: 430ter), to the nominated property *Frontiers of the Roman Empire – The Danube Limes (Western Segment)* (Ref: 1608) and to the Thematic Study and Nomination Strategy presented to the World Heritage Committee in 2017. This is followed by a general sketch of the Lower German Limes (section 2.a.2).

The main distinctive characteristics are outlined in more detail in section 2.a.3, while the main physical elements are presented in section 2.a.4. An explanation of the selection process and an overview of the component parts and of the elements represented in them can be found in section 2.a.5.

2.a.1 Introduction

***Frontiers of the Roman Empire – The Lower German Limes* represents the external boundary of the Roman province of *Germania inferior* or Lower Germany, which was part of the north-western frontier of the Roman Empire. It is the earliest example of a linear frontier, set in a dynamic riverine landscape which forced the Roman military engineers to develop innovative solutions to the challenge of creating a frontier in a constantly changing landscape context. It is a distinctive section of the Roman frontiers, which justifies its nomination as a separate World Heritage site, alongside other frontier sections in Europe, and alongside potential sections in North Africa and the Near East at some stage in the future.**

The Roman Empire is one of the largest known from history, encircling the Mediterranean Sea across the three continents of Africa, Asia and Europe. Gradually expanding from c. 500 BC onwards it existed for a millennium in the West and two millennia in the East, reaching its largest extent in the 2nd century AD.

The external frontiers of the Empire – often referred to by the Latin term of *limes*, plural *limites* – constitute a tangible manifestation of its ambition to dominate the known world and of the spread of its culture and traditions. At the height of the Empire in the 2nd century the frontiers stretched over 7,500 km in a wide ring around the Mediterranean, with thousands of fortresses, forts and watchtowers lined up along rivers, deserts, mountain ranges and artificial barriers (fig. 2.1).

The establishment of this military infrastructure thoroughly changed the landscape and spatial organisation at the periphery of the Empire. At the same time the frontier garrisons and their following of families, merchants and other civilians triggered the interchange of cultural values, introducing traditions from



Fig. 2.1 Map of the Roman Empire under the Emperor Antoninus Pius (AD 138–161).

the Mediterranean and from other, more distant parts of the Empire, and absorbing local influences in return.

The empire-wide deployment of army units and of their commanding officers required a large degree of uniformity in military installations, but the setting of these installations in very different landscapes and the varied tasks required of them and their garrisons demanded adaptations to local conditions. As a whole, therefore, the frontiers of the Roman Empire constitute a single but complex and varied monument.

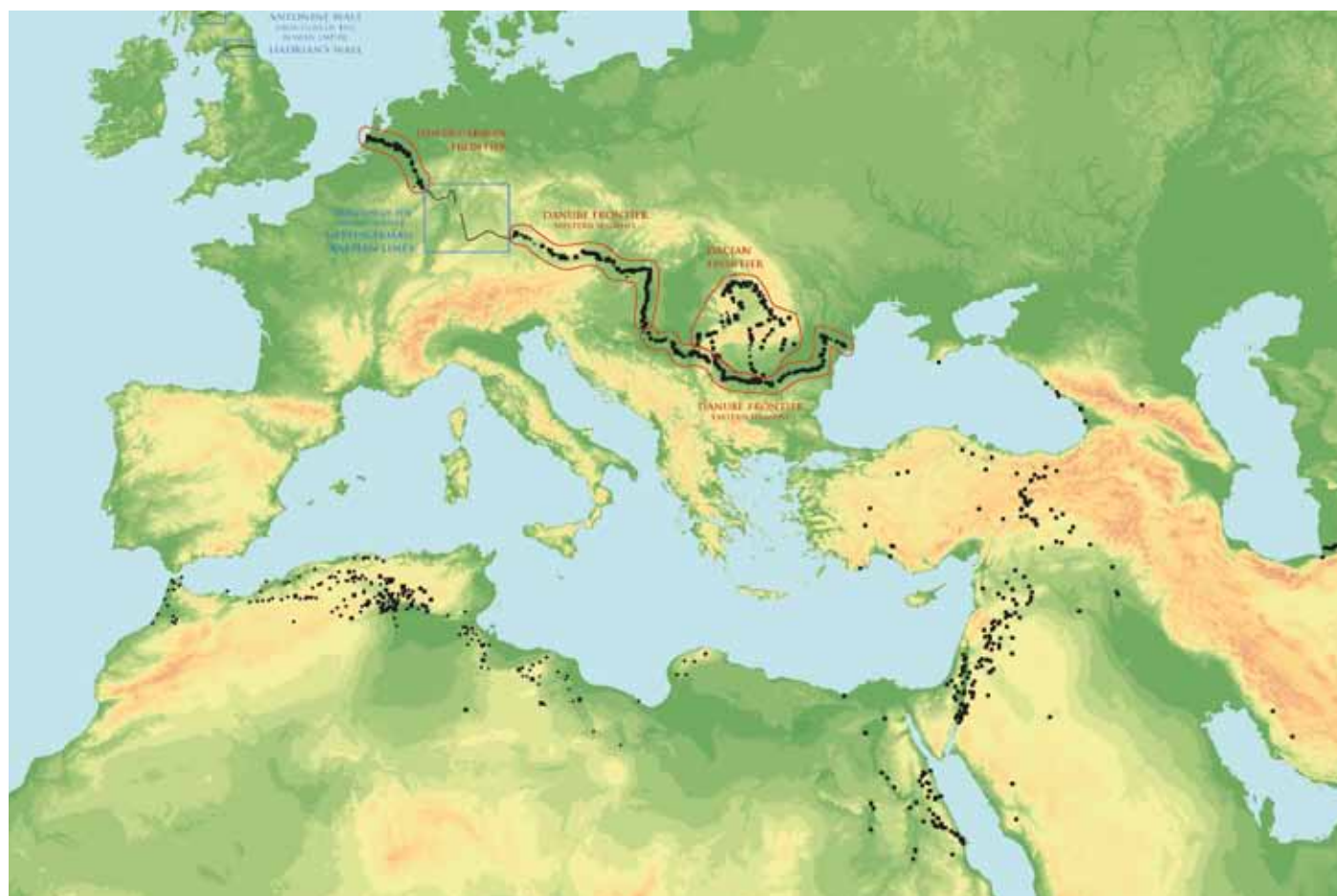
As an exceptional testimony to a long-lived world empire with an immense cultural impact the frontiers of the Roman Empire qualify for World Heritage as a transboundary monument extending over three continents. Their eligibility is demonstrated by the successive inscription on the World Heritage List of three frontier sections in Europe, under the joint heading of Frontiers of the Roman Empire: Hadrian's Wall in northern England (1987, Ref: 430), the Upper German-Raetian Limes in Germany (2005, Ref: 430bis) and the Antonine Wall in Scotland (2008, Ref: 430ter). Since the early 2000s it has been the ambition of the

States Parties involved in the preparation of proposed nominations of Roman frontier sections 'to create a World Heritage site encompassing all the frontiers of the Roman Empire [...] as evidence of the remains of one of the world's greatest civilisations and as a symbol of common heritage'.¹ At the inscription of the Upper German-Raetian Limes in 2005 the World Heritage Committee recommended the idea of a 'wider, phased, serial transboundary nomination to encompass remains of the Roman frontiers around the Mediterranean Region'.² After an expert meeting on serial properties and nominations in 2010,³ however, a phased approach was no longer advised.

¹ Quoted from the Summary Nomination Statement included in the nomination dossier for the Upper German-Raetian Limes p. 410 (< <http://whc.unesco.org/uploads/nominations/430ter.pdf> > [accessed 14.11.2019]).

² Decision 29 COM 8B.46.

³ UNESCO World Heritage: Serial Properties and Nominations. International expert meeting on World Heritage and serial properties and nominations. Ittingen, Switzerland, 25–27 February 2010 (Ittingen 2010). Cf. decision 34 COM 9B.



In 2017 a new nomination strategy was advanced in a thematic study written at the advice of ICOMOS International.⁴ The study provides an overview of all frontiers of the Roman Empire as they existed during the 2nd century AD. It also offers a comparison of frontier sections differentiated on the basis of differences in landscape setting, typology of frontier installations and character of external threats. For Europe, three future nominations were proposed as distinct properties (fig. 2.2):

- the frontier along the river Danube, nominated in January 2018 as *Frontiers of the Roman Empire – The Danube Limes (Western Segment)* (Ref: 1608);⁵

- the frontier along the lower course of the river Rhine, presented in this dossier as *Frontiers of the Roman Empire – The Lower German Limes*;
- the frontier of the Roman province of *Dacia* (modern Romania).

If accepted, these three sections would constitute three separate World Heritage properties, alongside the existing serial World Heritage property (Ref: 430ter).

In view of the current political situation in several of the countries concerned it was not feasible to outline a detailed nomination strategy for the frontiers in the Near East and North Africa, but the thematic study offered a broad division for these areas as well:

- the desert frontier in Africa, Egypt, the Roman province of Arabia and the southern part of the province of Syria, with the former provinces of Numidia and Mauretania set apart on account of their mountainous frontier sections;
- the frontier of northern Syria and the province of Cappadocia which was facing Rome's most powerful rival, the Parthian Empire.

In 2019 the feasibility of nominating sections of the Roman frontier in the Near East and North Africa

Fig. 2.2 The existing property *Frontiers of the Roman Empire* (blue) and the three envisaged additional properties for the European frontiers (red).

⁴ R. Ployer/M. Polak/R. Schmidt, *The Frontiers of the Roman Empire – A Thematic Study and Proposed World Heritage Nomination Strategy*. Advised by ICOMOS-International and commissioned by the Intergovernmental Committee of the 'Frontiers of the Roman Empire' World Heritage Site (UK, DE) and the Bratislava Group (Vienna, Nijmegen, Munich 2017). Cf. decision 41 COM 8B.50.

⁵ The 2018 nomination concerns the western segment of this river frontier, in Germany, Austria, Slovakia and Hungary. It is intended to nominate the eastern segment, in Croatia, Serbia, Bulgaria and Romania, in a second step, as a major extension. The nomination of the western segment has been referred to the States Parties by the World Heritage Committee in 2019 (decision 43 COM 8B.23).

Fig. 2.3 Riverine landscape near Xanten. The site of the double-legionary fortress of Xanten-Fürstenberg ▶28 (centre right) situated today on the left bank of a now abandoned river course of medieval date (right), today's course of the Rhine (top right corner), the modern-day town of Xanten (top left corner) and Xanten-CUT ▶27 (far top left corner).



has been explored in a meeting during the 43rd session of the World Heritage Committee at Baku (Azerbaijan). It is intended to find a way forward at a joint meeting of representatives from States Parties on all three continents in 2020, in advance of the 44th session of the World Heritage Committee at Fuzhou (China).

2.a.2 General description

Frontiers of the Roman Empire – The Lower German Limes is a river frontier, which developed around the beginning of the Common Era on the left bank of the lower course of the river Rhine. This serial, transnational nomination encompasses a selection of 91 military installations and 49 associated structures located in the modern countries of Germany and the Netherlands. They are spread out over c. 400 km along the Lower Rhine. The military installations belong to a wide range of types and sizes. The associated structures include infrastructural works, supporting facilities and civil settlements. Excavated canals, ships, quays and other riverine infrastructure illustrate the impact of the river dynamics.

The Lower German Limes is a river frontier, which developed around the beginning of the Common Era on the left bank of the lower course of the river Rhine, known as the Lower Rhine. By AD 85 at the latest, the Lower Rhine frontier zone and its direct hinterland were converted into a separate province named *Germania inferior* or Lower Germany, renamed *Germania*

secunda or Second (part of) Germany in the late 3rd century AD (fig. 2.3).

Well over a hundred military installations of varying sizes are known or assumed to have existed within the province and in its foreland across the Rhine. Half of them stood on the left bank of the river, while the others were divided over three areas: to the east of the Rhine, along the North Sea coast and in the hinterland. This nomination is limited to a selection of 91 military installations and 49 associated structures along the Lower Rhine. These 140 elements of the frontier system are divided over 106 separate component parts located in the modern countries of Germany and the Netherlands. The nomination therefore concerns a serial, transnational World Heritage property.

Most of the military installations included in this nomination are located along the left bank of the Lower Rhine, from Valkenburg ▶1 near the North Sea coast in the west to Remagen ▶44 on the fringes of the Rhenish Massif in the south, covering a distance of c. 400 km. The bridgehead fort of Köln-Deutz ▶38, the temporary camps of Wesel-Flüren ▶26 and the fortlet of Duisburg-Werthausen ▶31 are located on the opposite river bank. The structures associated with the military installations, such as roads and industrial sites, are distributed across the frontier zone. The military installations comprise a wide range of sizes, from as large as c. 900 × 600 m for the double-legionary fortress of Xanten-Fürstenberg ▶28 to barely 5 × 5 m for the watchtower of Neuss-Reckberg ▶34a. These installations were all surrounded by one

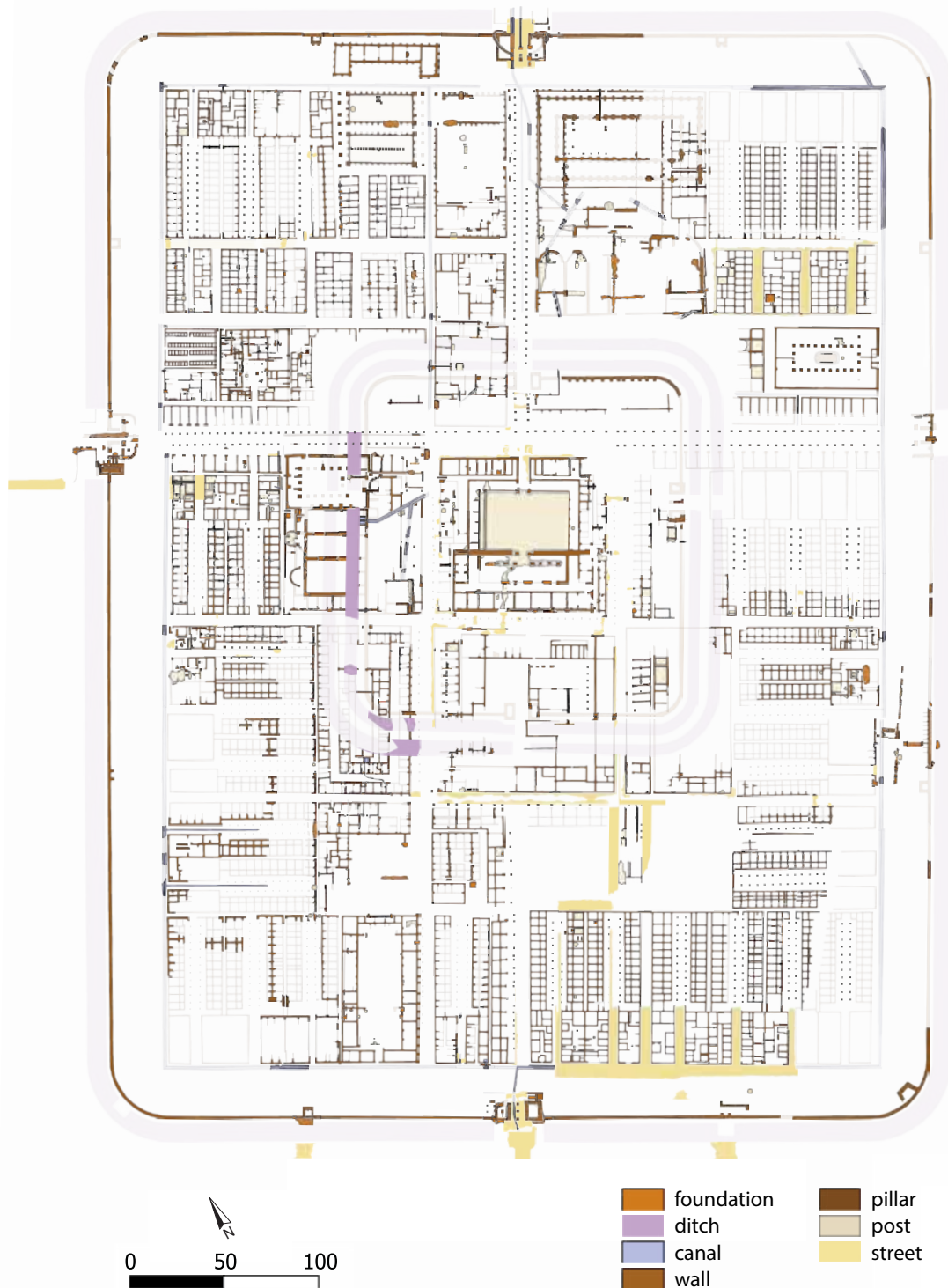


Fig. 2.4 Neuss-Koelenlager [►33](#) features one of the most complete ground plans of a legionary fortress known today. After its abandonment in c. AD 100, the site of the fortress was occupied by a cavalry fort.

to five ditches and, with the exception of the watch-towers, by ramparts made of timber, timber-and-earth or stone, usually provided with three or four gates, corner towers and intermediate towers. The internal buildings normally included a headquarters building, a commander's house and several barrack blocks, alongside additional structures such as workshops and storage buildings. The fortifications were manned by infantry, cavalry or a mixture of both, but Köln-Alteburg [►39](#) was a fleet base with specialised personnel. Most of the fortifications were in use for decades or longer, but in the vicinity of the legionary

fortresses of Bonn and Xanten close to two hundred temporary camps have been identified, constructed mainly for training purposes (fig. 2.4).

The maintenance of the military installations and their garrisons relied on a large number of supporting facilities. These included first of all infrastructural elements like the military road or 'Limes road' connecting the forts and – characteristic of this frontier in a dynamic river landscape – ships, quays and revetments along the river bank and an extremely rare example of an excavated canal. Other facilities illustrate the immense logistics required for the maintenance of

the army: an aqueduct and kilns for the production of lime, bricks, tiles and pottery.

Permanent forts and fortresses were surrounded by civil settlements which offered accommodation to the families of the soldiers and a wide range of economic activities. These agglomerations developed along the roads entering the forts, with shops and workshops facing the road, living quarters in the rear of the buildings and kilns, wells, latrines and kitchen gardens in the backyards. The cemeteries where the remains of deceased soldiers and civilians were buried were generally located on the outskirts of the settlement.

The extramural civil settlements constituted the interface between the military system and the society in which it was implanted. They served as an inlet for regional products and services to the army, but equally as an outlet for Roman products and values to the region. The interchange of cultural traditions can be clearly discerned in the religious domain, with monumental temples succeeding indigenous open-air sanctuaries and soldiers worshipping regional deities. On the Lower Rhine, towns were inextricably bound up with the military infrastructure. The administration of a Roman province relied heavily on district capitals, but the Lower Rhine was an area without an urban tradition. Consequently, all four towns along the Lower Rhine – *Forum Hadrian* (Voorburg), *Ulpia Noviomagus* (Nijmegen), *Colonia Ulpia Traiana* (Xanten), *Colonia Claudia Ara Agrippinensium* (Köln) – were founded or actively promoted by emperors and built with the assistance of the army. They vividly illustrate the formidable impact of the Roman military presence

on the landscape and society of the periphery of the Empire.

The river Rhine performed the same tasks as artificial barriers in areas where no convenient rivers were available, such as Hadrian's Wall: controlling movement into and out of the Empire, suppressing brigandage and raiding, and supporting a coherent military infrastructure. Navigable rivers were the preferred transport arteries for heavy and bulky loads, although the sailing season was largely confined to the period from April to September. From the point of view of logistics, it was advantageous for a fort to be located on a river bank, and each fort in the Lower Rhineland is likely to have had mooring facilities.

The Roman Rhine – personified as a male deity known as *Rhenus* (fig. 2.5) – differed in many aspects from the Rhine of today. For most of the year the river bed was much wider and shallower. In the Roman period the river developed large meanders, which gradually migrated downstream through the continuous erosion of outer bends and accretion of inner bends, until they were cut off as the river created a new channel.

As long as the river cut its bed into older sediments forts could be built on the edge of the river terrace and remain free of flooding. However, closer to its outlet into the sea the river started to deposit sediments on its banks, marking the beginning of the river delta. For the Roman Rhine this point was located near the modern border between Germany and the Netherlands.

In the delta, forts built on the edge of the river bank were constantly exposed to flooding. The archaeological evidence shows that the whole of the military infrastructure in the Rhine delta suffered from periodic flooding, destroying some parts and covering others with layers of sediment. This was the price of locating military installations close to the river for the purposes of observation and accessibility for ships. Upstream from the delta the forts were not immune to erosion by the river either, as the bank of the river terrace could be undermined in outer bends.

Since river bends gradually migrate downstream, erosion of the river bank in front of a fort could make way for accretion, and active meanders could be cut off by new channels (fig. 2.6). In such cases accessibility for ships deteriorated. This could be countered by building new quays further out, backfilling the intermediate space with soil, brushwood and debris. The process of silting up was quite often accelerated by use of the river as a convenient dump for settlement waste. In several places these riverside dumps have been preserved as they were eventually sealed by sediment. These sealed rubbish deposits provide a wealth of information about everyday life on the Roman frontier.

Rivers were navigated by ships, and over the centuries the Lower Rhine has relinquished wrecks of some twenty cargo ships, two patrol crafts and several dug-

Fig. 2.5 Relief of a burial monument in the LVR-LandesMuseum Bonn depicting the horned and bearded personification of the river Rhine (*Rhenus bicornis*).



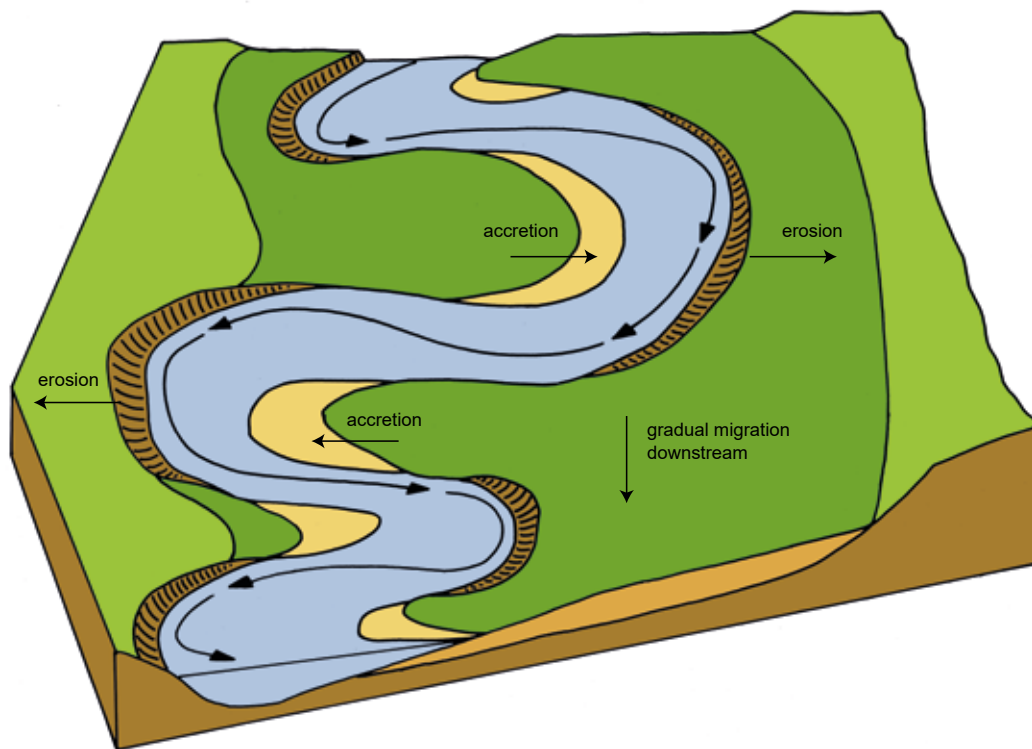


Fig. 2.6 Simplified model of a meandering river, showing the process of accretion and erosion in the inner and outer river bends.

out canoes. While several of these ships will have been wrecked by accident, others were deliberately sunk to protect river bends against erosion or to serve as a foundation for a new quay. The number of excavated ships is so high that it can be predicted with confidence that some are hidden in sections of the Rhine included in component parts of the nominated property. This is known to be the case for two component parts which contain remains of incompletely excavated ships.

2.a.3 The first linear frontier, embedded in a dynamic river landscape

Frontiers of the Roman Empire – The Lower German Limes may be considered as the cradle of Roman perimeter defence. Another distinctive aspect is its setting in the dynamic landscape of a lowland river and its delta.

When Roman troops first arrived on the Rhine in the mid-1st century BC, perimeter defence was still an unknown concept. Thus far, Rome had constantly been expanding its territory, and internal unrest and external attacks had been countered on an ad hoc basis. In retrospect, the first linear frontier on the periphery of the Empire developed in the early 1st century AD, although it may not have been conceived as such at the time.

The Lower German Limes, as this first linear frontier is commonly known, may therefore be considered as the cradle of Roman perimeter defence. Thanks to the wide range of military installations and their excellent preservation *Frontiers of the Roman Empire – The Lower German Limes* is of extraordinary importance for the understanding of this strategic development.

Another distinctive aspect of *Frontiers of the Roman Empire – The Lower German Limes* is its setting in the dynamic landscape of a lowland river and its delta. Serving both as a demarcation line and as a major transport route, the river needed close military observation. Both functions required tailor-made strategies and installations, which are either unique to this frontier section or much better preserved than elsewhere. These and other characteristics, which clearly distinguish *Frontiers of the Roman Empire – The Lower German Limes* from other sections of the Roman frontiers, are outlined in the sections below.

THE FIRST LINEAR FRONTIER

The Lower German Limes developed as a result of Rome's inability to control Germanic groups across the Rhine by diplomatic means or by territorial expansion. In the early decades of the 1st century AD the military infrastructure on the left bank of the river was converted into a linear frontier, the first instance of perimeter defence.

It was Julius Caesar who first took the Roman army as far north as the river Rhine, during his conquest of Gaul (58–52 BC). In the course of his military campaigns he was confronted with various Germanic groups from across the Rhine: mercenaries participating in internal Gaulish conflicts, migrants searching for new areas to settle and raiders profiting from the chaos of war.

The gradual conversion of Gaul into a Roman province in the decades following the conquest did not put an end to the Germanic incursions. Initially, Rome replied with punitive expeditions across the

Rhine, and one of these led to the establishment of the first archaeologically attested military base in the Lower Rhineland, at Nijmegen-Hunerberg ▶15 in 19 BC (fig. 2.7). When neither these brief campaigns nor the displacement of Germanic groups to the left river bank had a lasting effect, Rome tried to subdue large parts of *Germania* to the east of the Rhine in large-scale wars, but peace treaties with conquered peoples were violated time and again, even when sealed with hostages. Once again, the large-scale deportation of Germanic groups failed to produce a lasting peace.

While in the Near East and North Africa Rome had been quite successful in securing its interests through negotiations with regional rulers, this diplomatic approach evidently failed in *Germania*. This was probably due to unrelenting migration pressure from the north and east, and to the absence of any central authority or of a tradition of written agreements. After nearly thirty years of gain and loss, the Emperor Tiberius concluded Roman offensives across the Rhine in AD 17, contenting himself with the successes achieved so far. While a triumph over *Germania* was being celebrated at Rome, the army was withdrawn to the left bank of the Rhine.

It is uncertain whether Tiberius considered the withdrawal as an abandonment or as a postponement of further actions in *Germania*, but in retrospect we can establish that the offensive was never resumed. The military installations on the left bank of the Lower Rhine were no longer a springboard for operations in *Germania*, but developed into the first linear frontier in the history of the Roman Empire, a clear and well-defended demarcation line.

In the late 90s AD the historian Tacitus complained that ‘it was taking so long before Germania was conquered’, but there is little reason to believe that further conquest was still a serious ambition at that time. By the mid-1st century the legionary fortresses of Xanten-Fürstenberg ▶28 and Neuss-Koenenlager ▶33, previously constructed in timber, were rebuilt in stone. This is generally considered to reflect acceptance by the Romans that the military deployment along the Rhine would remain unchanged.

An early awareness of the permanence of the status quo is also indicated by the appearance of many smaller military installations soon after AD 17. The preceding period of continuous expansion had been characterised by the deployment of field armies operating from large bases. The early base of Nijmegen-Hunerberg ▶15 with a capacity of 10–15,000 troops is a fine example of this category. During this offensive stage, fortifications for less than five thousand men were rare and possibly confined to nodes in the supply system needing protection. Consolidating territorial gains demanded a different deployment, however, with a fine-meshed network of smaller posts to tighten control; spreading the units may also have eased the pressure of supply. The second quarter of the 1st century AD saw a sudden increase in the number of forts for 500 men or less. A whole series of these was built in the western delta, which had been without military occupation thus far. In the same period the first watchtowers were built here, along a particularly winding stretch of the river which was difficult to oversee. The main task of this tight screen of forts and towers in the delta must have been the protection of a supply line to the Roman troops in Britain, the



Fig. 2.7 Section through the two ditches on the eastern side of the early operational base of Nijmegen-Hunerberg ▶15. View from the south.

conquest of which was the main military focus from AD 43 onwards. That the restoration of the Roman claim on Germanic territory across the Rhine had lost its priority is clearly illustrated by the termination of a military campaign with precisely this aim in AD 47, on explicit imperial order.

Upstream from the delta the increase in smaller forts is less conspicuous, but by the middle of the 1st century most of the gaps between the legionary fortresses had been plugged.

ADAPTING (TO) A DYNAMIC RIVERINE LANDSCAPE

In the Roman period the Rhine continuously changed its course. The river dynamics hampered shipping and threatened the military posts which were built on the edge of its bank. Various infrastructural works were undertaken to improve the navigability. The need to secure river traffic led to the adaptation of fort designs, the construction of watchtowers and various measures to cope with flooding and erosion of the river bank.

On leaving the Rhenish Massif, with its average elevation of 500 m above sea level, the river Rhine gradually descends from a height of c. 60 m down to sea level on the North Sea coast. Before it was restricted by dikes and other manmade constructions in the Middle Ages, the Rhine had a very winding course, with large meanders gradually migrating downstream. In the delta it split into several branches. The river dynamics hampered shipping and threatened the military installations which were built on the edge of the river bank in order to exercise control over the river itself and the opposite bank.

Navigability was improved by the construction of a groyne – a partial dam extending across the river bed – and at least two canals. The groyne was designed to feed more water into the most northerly Rhine branch in the delta. It must have been located between the forts of Herwen-De Bijland ▶19 and Kleve-Keeken ▶20 and is mentioned in an inscription from the latter site. One of the canals was probably dug to connect a creek system discharging into the Rhine near the fort at Arnhem-Meinerswijk ▶12 to the peat lakes which provided access to Germanic territories further north and east. Its precise location is unknown. The second canal has been firmly attested by archaeological excavation. It was built to connect the Rhine to the river Meuse further south, just behind the coastal barriers, to avoid the risks of a passage by sea (Corbulo's canal ▶4). Its course has been recorded over a distance of at least 11 km (fig. 2.8). The sides of the canal were consolidated by timber posts, which have survived thanks to the high groundwater table in the delta. Roman canals are extremely rare, and this excellently preserved example is a vivid illustration of the pains taken by the Roman army to improve the infrastructure of the river delta.

With the exception of Bunnik-Vechten ▶11, all the forts in the delta with a known ground plan display a design which deviates from the standard plan attested on all other frontiers. Normally a fortress or fort is divided into three strips of buildings, with the headquarters in the centre of the middle strip. The forts in the delta, however, have only two strips of buildings, with the headquarters in the rear part. Measuring no more than 0.9–1.6 ha these 'delta type' forts are considerably smaller than other forts.



Fig. 2.8 Section through Corbulo's canal near the Romeinsepada component part ▶4f. The clay filling of the c. 14 m wide and 1.2 m deep canal stands out clearly from the peat layers in which it was excavated.

Although the width of the natural levees to the left of the Rhine does not exceed 400 m in some places, the locations of all fort sites in the delta could have provided enough space for a standard size fort, so the divergent design cannot be a consequence of space constraints. Instead, the size of the garrison seems to have been the key determinant, with less than a regular unit of 500 men being considered sufficient to perform the assigned task.

The forts in the delta share an extremely vulnerable position on the edge of the river bank, where they repeatedly suffered from flooding. Nevertheless they were invariably rebuilt on the same spot, even if a more elevated position was available at some distance from the river channel. This reveals that the very specific bank edge siting of these forts was an absolute requirement for the fulfilment of their primary task: the observation and protection of river traffic. Most were built in AD 40 or soon after, a period for which we have indications of Germanic piracy.

The effects of flooding and erosion by the river can be seen at various fort sites. At Kalkar-Bornsches Feld ►24 the northeast corner of the fort was destroyed by the erosion of the terrace on which it was built. The gap was simply closed by a new rampart, at an angle to the front and side of the fort. At several forts in the delta successive building phases are separated by layers of river sediment and artificial raised levels, revealing that despite considerable efforts flooding could not be avoided. Occasionally, the layers of sediment are so thick that a fort or part of it may not have been usable for some time. This has been taken as an indication that the forts in the delta were not continuously occupied; only when the strategic situation required. However, it is equally possible that a flooded fort was replaced by a temporary camp nearby, for the time needed to rebuild it.

The river bank sections in front of the forts were consolidated by rows of posts and revetments, most of which collapsed after a period of time. Mooring facilities for ships were secured by more elaborate constructions, which often shared the same fate. If erosion was replaced by accretion, the river bank was regularly built out to maintain access to the receding channel.

The vulnerability of the military infrastructure within the dynamic riverine landscape is also demonstrated by the Limes road connecting the forts. Upstream from the delta it was established on the flood-free river terrace, on a low embankment or artificial levee paved with gravel and flanked by drainage ditches. In the delta the preferred location for the road was the edge of the natural levee of the Rhine, only just above the wet floodplain. Where required, to keep the course of the road straight, the line crossed the floodplain or approached the erosive river channel. In such wet or vulnerable conditions the road embankment

was lined with rows of posts and occasionally even heavier constructions, to survive periodic flooding. Although most of these adaptations to the instability of the natural conditions were local measures, there were two coherent supra-regional campaigns of renovation, in AD 99/100 and AD 123/125, following visits of the Emperors Trajan and Hadrian.

A particularly winding stretch of the Rhine between the forts of Utrecht-Hoge Woerd ►8 and Woerden-Centrum ►6 is one of the few areas where watch-towers have been attested, overlooking large meanders. They were probably built in the 40s AD, contemporaneous with the delta type forts. Upstream from the delta, the considerably later tower of Neuss-Reckberg ►34 was also located in a winding section of the river, suggesting that towers may have been a common element of the military infrastructure, required for proper surveillance of the dynamic river landscape.

ROMAN MILITARY CONSTRUCTION IN TIMBER

Thanks to the outstanding preservation of organic remains and to the repeated rebuilding of vulnerable forts, *Frontiers of the Roman Empire – The Lower German Limes* constitutes a showcase of Roman construction in timber. The rich preserved remains also offer a clear insight into the exploitation of natural woodlands. Dates derived from tree-ring patterns provide an almost inconceivably fine chronological resolution for the exploitation of forests, the history of the military infrastructure and developments in Roman timber construction.

When Roman armies were on campaign they built temporary camps with earthen ramparts. Timber, natural stone and brick were only used when bases were expected to be permanent, or at least long-lasting. In the Lower Rhineland timber and clay were abundant, but natural stone was only available in the very south. The legionary fortresses were the first to be rebuilt in stone, from the mid-1st century onwards, but it would take another century before all the smaller installations had followed this trend.

Thanks to the outstanding preservation of organic remains and to the repeated rebuilding of vulnerable forts, *Frontiers of the Roman Empire – The Lower German Limes* constitutes a showcase of Roman construction in timber and earth-and-timber. The fort of Valkenburg-Centrum ►1 is internationally renowned for its standing timber remains, but the nomination includes several sites with similar preservation conditions (fig. 2.9).

Prior to their rebuilding in stone, the defensive walls consisted essentially of the soil dug out from the surrounding ditch or ditches. The exterior of the wall was clad with timber frames or piled-up sods. Timber frames consisted of horizontal planks locked up be-



Fig. 2.9 Southwest corner of successive defensive walls of the fort at Valkenburg-Centrum ►1. Left: track of horizontal beams constituting the base of an earthen rampart. Centre: sleeper beams of the fronts of two successive earth-and timber ramparts. Right: collapsed remains of a stone wall.

hind uprights which were driven into the ground or placed on sleeper beams set in trenches; the front and rear faces of the ramparts were connected by horizontal tie beams. Ramparts with facings of sods had foundations of horizontal trunks and were further stabilised by adding horizontal timber frames at regular intervals of height, anchored by vertical posts.

Timber gate towers, corner towers and intermediate towers usually rested on four to ten heavy uprights; in the delta these constructions had foundations of massive horizontal planks. This construction method was also used for free-standing timber watchtowers. Aboveground remains of towers have not been attested in excavations so far.

The streets within the fortifications were metalled with gravel or, near the coast, with shells. Along the delta road substructures of beams and planks have been found, occasionally overlying wooden drainage channels; such timber substructures are likely to have occurred elsewhere, too. Wells were provided with timber linings, consisting of wickerwork, reused wine barrels, or horizontal planks kept in place by uprights. Internal buildings made of timber had the same basic construction as the defensive walls, with uprights either driven into the ground or resting on sleeper beams. The walls of the buildings were made of wattle-and-daub or clad with planks. Well preserved remains of the former construction type are known from the delta. They consist of horizontal laths slid

into asymmetrical notches in the uprights, providing a frame for vertical wattle covered with loam. The existence of walls of horizontal planking has been deduced from the occurrence of closely spaced uprights without notches for wattle frames. Floors consisted of tamped loam or woodchips, occasionally applied over planks or branches.

Frontiers of the Roman Empire – The Lower German Limes provides many well-preserved examples of these and other timber constructions, in rare cases even including aboveground elements. Construction details like half-lap and mortise-and-tenon joints are almost without parallels on the Roman frontiers.

Stretches of the Limes road that have been lined with posts or otherwise consolidated with timber provide insight into the logistics of major building campaigns, including the provenance of the trees used, and reveal many details of woodworking. This is the case also for the rows of posts lining Corbulo's canal.

The more than thirty shipwrecks preserved in the Rhine channel constitute another valuable source of timber construction technology. Most wrecks are of heavy, flat-bottomed cargo ships up to 35 m long (fig. 2.10), built with flush-laid planking in a bottom based construction with oak planks up to 20 m long and 77 × 10 cm in section. Two patrol craft from Köln and Bunnik-Vechten ►11, however, were built largely from considerably lighter pinewood, in a Mediterranean mortise-and-tenon technique. Small-scale trans-



Fig. 2.10 Large cargo ship (a) excavated at Utrecht-Limes road | De Balije ▶ 7c now exhibited in the site museum Utrecht-Hoge Woerd. The flat-bottom ship from Xanten (b) may have also been used as a reaction ferry for crossing the Rhine.

port was provided by dugout canoes: simple vessels made from hollowed trees up to 10 m long. Some of these were reused as creels.

The well-preserved timber remains also offer a clear insight into the exploitation of natural woodlands. The identification of wood species and their natural habitats has revealed that initially the riverine forests of the region were exploited; these mainly consisted of ash, alder, elm and willow. Regional oak was gen-

erally of poor quality and oak was therefore mainly procured from outside the delta. Pine was supplied from the Upper Rhine area. Once the regional forests were cleared of the best timber, the area depended largely on imported oak.

Analysis of tree-ring patterns adds further detail to this field of research, as it permits the identification of growing conditions and of regional groups of timber. By comparing tree-ring sequences to known dated

ring patterns it is possible to establish very precise felling dates for oak, and in the western delta for ash and elm also. This provides an almost inconceivably fine chronological resolution for the exploitation of natural resources, the history of the military infrastructure and developments in Roman timber construction.

THE FOOTPRINT OF A FRONTIER

The impact on the regional landscape and society of an army of tens of thousands of men must have been immense, as the area was only sparsely populated. Accommodating the troops required much more than fortifications alone: the entire infrastructure for their maintenance and supply had to be built from the ground up. The involvement of the army in the development of an urban infrastructure demonstrates that despite obvious cultural interchanges between the military and the regional population, the transformation of the Rhineland into a Roman province was a slow process and required substantial imperial encouragement.

At the beginning of the Common Era the left bank of the Rhine was probably still partly forested. Arable farming and stockbreeding were practised locally on too modest a scale to generate large surpluses, and there were no valuable minerals to extract. Consequently, there was no economic basis for centralised power. This is reflected in the settlement pattern, which was characterised by scattered clusters of usually less than a handful of farmhouses and by a lack of central places, although the latter may have been partly compensated for by regional sanctuaries.

In the early phase of the Roman occupation the army of Lower Germany is likely to have consisted of 40–

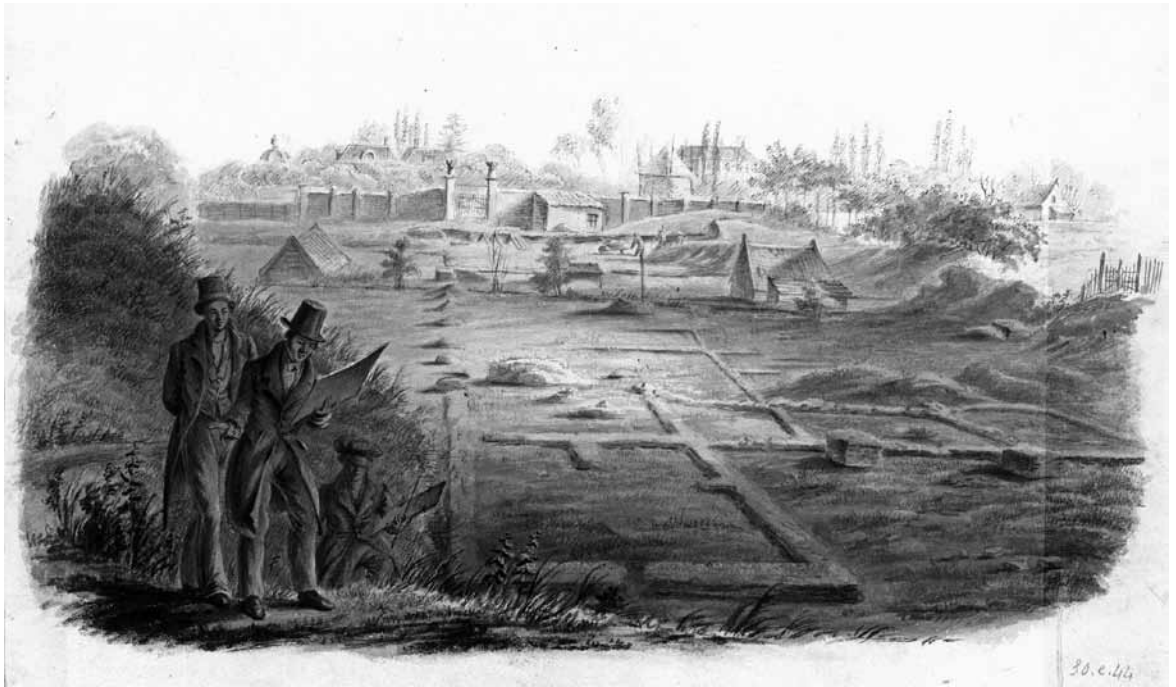
50,000 men, not counting non-combatant personnel and camp followers. From a numerical point of view alone it is evident that the impact of the army was immense, both on the landscape of the Lower Rhine and on the regional population. Accommodating the troops required much more than fortifications alone: the entire infrastructure for their maintenance and supply had to be created. At a later stage the army was also involved in the development of an urban infrastructure required for the administration of the province. Contacts between the military and the indigenous population led to an interchange of merchandise and values, but the transformation of the Lower Rhineland into a Roman province appears to have been a slow and reluctant process, despite imperial encouragement.

The Lower German frontier contains a wide range of military infrastructural works. The Limes road connecting the military installations over land is the most obvious manifestation of the infrastructure that was rolled out on the left bank of the Rhine. As early as 17 BC, immediately following the foundation of the earliest known military base in the region, a road was built from Trier on the river Moselle to Köln on the Rhine. This road constituted a more secure connection to the hinterland than rivers like the Meuse and Rhine with their rapidly changing water levels. The road was soon extended downstream from Köln, but for as yet unknown reasons it took nearly a century before the North Sea coast was reached. Although the Rhine was a less reliable route than the road, the river was of major importance for the transport of heavy and bulk cargoes. The particular infrastructure characteristic of this frontier in a dynamic riverine landscape has already been discussed above (fig. 2.11).



Fig. 2.11 Excavation of a ship and the Limes road at Utrecht-Limes road | De Balije ►7c in 1997. Front: rear part of a cargo vessel. Centre: parallel rows of posts lining the embankment of the Limes road, with horizontal planks on the inner sides. View from the north.

Fig. 2.12 Lithography showing the first scientific excavation (1827–1834) at Voorburg-Arentsburg ►3 (*Forum Hadriani*), with foundations of stone buildings in the centre of the Roman town. The remains in the centre of the image are probably still preserved.



The construction and maintenance of the military installations and transport system demanded huge quantities of building materials. Initially, timber was the main source. The felling and processing of trees has left no tangible traces, apart from the many preserved remains of defensive works, buildings and other constructions. While buildings were initially roofed with wooden shingles or reed, roof tiles made their appearance by the middle of the 1st century AD. The rebuilding in stone of many military posts required large quantities of lime and natural stone, which only occurred in the south.

Maintaining the troops with food, drink, tools and equipment was also a major concern, especially since considerable quantities had to be kept in stock to survive sieges and hitches in the supply system. Warehouses and workshops in the forts and the adjacent civil settlements give an idea of the required facilities, but some were located at a distance. Drinking water was usually obtained from wells and from cisterns in which rain water was collected, but several legionary fortresses are known to have been serviced by aqueducts.

All these buildings, constructions and facilities give a clear picture of the massive footprint of the army on the landscape, but there are also less direct indicators. The native population does not appear to have been very keen on moving away from a subsistence economy that generated insufficient wealth to maintain a powerful elite or to enable public munificence, both of which were prerequisites for urban development. By AD 5 at the latest, the Emperor Augustus gave an early impetus to the development of a provincial capital by establishing a settlement with urban pretensions at what is now known as Köln. The promotion

of this settlement to a *colonia* – *Colonia Claudia Ara Agrippinensium* – by the Emperor Claudius in AD 50 constituted a further strong encouragement to its development into a city. A *colonia* was the highest rank in the Roman municipal system and its foundation involved the settlement of army veterans.

The development of regional capitals, which formed the basis of the provincial administrative system, proceeded even more slowly. Development was eventually forced by the promotion or creation in the early 2nd century of the towns of *Colonia Ulpia Traiana* at Xanten and *Ulpia Noviomagus* or *Municipium Batavorum* at Nijmegen by the Emperor Trajan, and of *Municipium Aelium Cananefatium* or *Forum Hadriani* at Voorburg by his successor Hadrian. There are several indications of military involvement in the construction of public buildings. Furthermore, VVoorburg-Arentsburg ►3 appears to have played a role in supplying the forts in the region, and Xanten-CUT ►27 took on defensive tasks in the 3rd and 4th centuries. On the Lower Rhine the urban and military domains were therefore closely knit (fig. 2.12).

The provincial capital at Köln was the seat of the governor or *legatus Augusti* ('envoy of the Emperor'), who was also commander-in-chief of the provincial army. The palace of the governor, or *praetorium* ►37, served as headquarters to the army and as the ultimate display of Roman culture to the regional population. A similarly hybrid position is illustrated by the sanctuaries on the Kalkarberg ►23 and at Elst ►13. Inscriptions on votive altars and other objects found on the Kalkarberg demonstrate that the temple was mainly visited by soldiers, whilst being dedicated to a Germanic goddess with the name of Vagdavercustis. The monumental temple at Elst, constructed

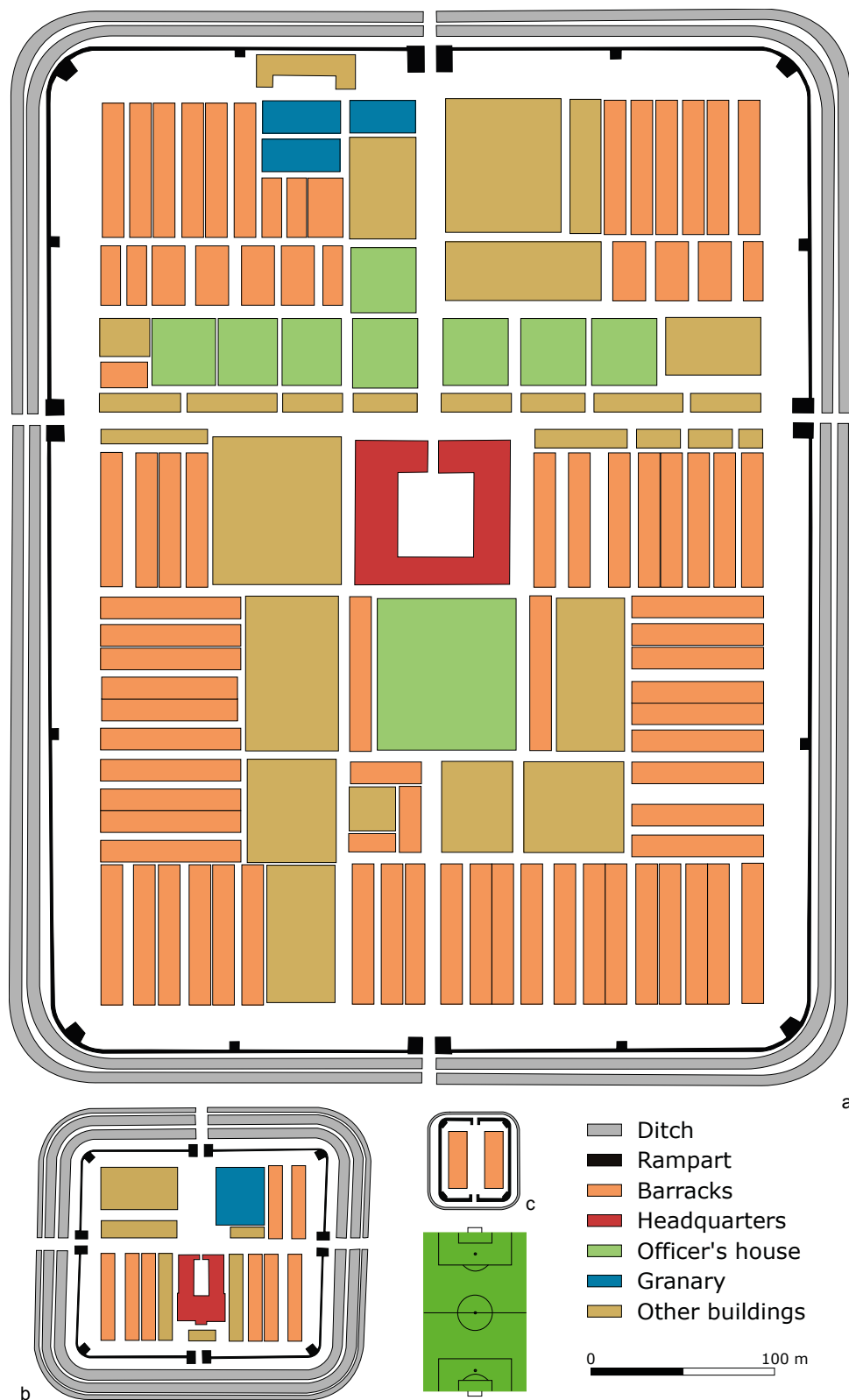


Fig. 2.13 Layout plans of military installations at common scale. Legionary fortress Neuss-Koenenlager ▶ 33 (a), auxiliary fort Valkenburg-Centrum | Kerkweg ▶ 1a (period 6) (b) and fortlet Duisburg-Werthausen ▶ 31 (c). Football pitch as benchmark

by or with the assistance of the army, succeeded a pre-Roman open-air sanctuary. Its architecture is a mixture of Roman and Gaulish elements, and it is the largest example of its kind known so far. These temples and other similar ones vividly illustrate the interchange of cultural values between the army as representative of the Roman Empire and the regional population.

MILITARY HISTORY OF THE WESTERN EMPIRE

Frontiers of the Roman Empire – The Lower German Limes is the only frontier section that spans the entire history of the Western Roman Empire in the imperial age.

As mentioned previously the Lower German Limes is the earliest linear frontier, and as such it encompasses

military installations from a period which is missing from other frontier sections. The earliest bases stand out through their large dimensions and irregular plans. They represent an offensive period in which large field armies were deployed and bases were too short-lived to make the effort to adapt the landscape to the requirements of standardised fort designs. The stage of consolidation of the military infrastructure on the left bank of the Lower Rhine from AD 17 onwards is illustrated by an increase in the number of forts for 500 men or less. Later in the 1st century such forts appear to have been occupied by individual auxiliary regiments, but there is increasing evidence that their garrisons may have consisted of mixed detachments of legionary and auxiliary soldiers in this early experimental stage (fig. 2.13).

In AD 286 the ruling emperor Diocletian (AD 284–305) decided to share the imperial power with Maximian (AD 286–305) and to divide the Roman Empire into a western part and an eastern part. With two interruptions this divide existed until the disintegration of the Western Empire in AD 430–490.

The Lower German frontier offers the full range of Roman military installations from the beginning of the imperial age to the end of the Western Empire, from vast operational bases for 10–15,000 men to watch-towers for a dozen or less. Besides the standard range of legionary fortress – auxiliary fort – fortlet – watch-tower, the frontier section includes special-purpose fortifications such as a fleet base, a bridgehead fort and temporary camps of different sizes and functions.

TREASURE-CHEST OF FRONTIER LIFE

Thanks to the water-logged conditions in many parts of the riverine landscape, organic remains and metal objects are often very well preserved. Rubbish deposits in river channels in front of military settlements constitute veritable treasure-chests

of everyday life on the frontier. They are an essential key to our understanding of the functioning of military settlements.

The wet conditions of the riverine landscape, which posed many problems to the Roman military engineers, greatly favoured the preservation of perishable materials. In water-logged conditions materials like wood, leather and seeds may survive millennia. Further, metal objects are preserved in mint condition, in contrast to when they are exposed to oxygen and the effects of manuring of arable fields and meadows.

Military bases were kept relatively tidy, which resulted in the miscellaneous objects that illustrate everyday life being discarded in large quantities outside the defences. On a river frontier a water channel was the most convenient place to deposit waste. As long as the water current was strong, most of the rubbish was washed away, but if the channel migrated away from the fort layered rubbish deposits accumulated. The accumulation of waste increased when the river bank was built out by constructing quays and revetments closer to the channel, backfilling the intermediate space with soil and debris.

These layered rubbish deposits constitute veritable treasure-chests of everyday life on the frontier. Well-preserved animal bones, seeds and pollen permit the reconstruction of the surrounding landscape, the diets of men and animals, and the sources of supply with animal and plant food. Leather waste includes remains of military equipment such as tents and shield covers. The most frequent leather finds are shoes, not just of soldiers, but also of women and children (fig. 2.14). They give an idea of the composition and age structure of the military settlement at large, and of changing fashions. Wooden objects may be as varied as parts of weapons, tools, furniture, combs and writing tablets, shedding light on military as well as civilian life. Metal objects cover a similarly wide field (fig. 2.15).



Fig. 2.14 Remains of leather shoes from Voorburg-Arentsburg ► 3 (Forum Hadriani): single-piece shoe (*carbatina*) for a child (a), soles of nailed sandals (b).



These riverine rubbish deposits are an essential key to our understanding of the functioning of military settlements. They occur most frequently in the delta, but have been attested at various sites upstream as well. Nijmegen-Kops Plateau ▶16 provides a very rare example of a 'dry' rubbish deposit. The slope of the ice-pushed moraine in front of the fort was used for dumping settlement waste. The preservation of organic material in the sandy subsoil of the moraine is obviously inferior to that of silted-up river channels, but the deposits nevertheless constitute a layered archive of the occupation history of the fort.

2.a.4 Elements of Frontiers of the Roman Empire – The Lower German Limes

This section provides an overview of all the elements of *Frontiers of the Roman Empire – The Lower German Limes*, in twelve categories. Each category is briefly elucidated, with references to the component parts in which it is represented. If a component part (or cluster) encompasses remains of two or more categories of elements it is listed in all relevant categories.

LEGIONARY FORTRESSES AND OTHER LARGE BASES

Until the army reforms at the end of the 3rd century, a Roman legion consisted of approximately 5,000 soldiers. The standard accommodation for such a unit covers c. 20 ha within the defensive walls. Neuss-Koenenlager ▶33 is one of the best-known examples of this type of installation on the Roman frontiers, with a so-called playing card shape – a rectangle with rounded corners. During the 1st century AD fortresses for two legions are known, of which that of Xanten-Fürstenberg ▶28 covering c. 56 ha is a classic exam-

ple. These legionary bases were initially built in timber and earth, but in the course of the 1st century the defensive walls and main internal buildings were rebuilt in stone. The fortress of Bonn ▶41 is one of the most long-lived on the Roman frontiers, still functioning in the early 5th century.

During the early offensive period large bases of irregular shape were constructed. The earliest example on the Rhine is that of Nijmegen-Hunerberg ▶15 measuring 42 ha, but the above-mentioned double-legionary fortress of Xanten-Fürstenberg ▶28 was preceded by an irregular shaped base, covering c. 57 ha. The irregular shaped bases were all built in timber and earth (fig. 2.16).

A singular construction is the Late Roman fortification within the city walls of the *colonia* of Xanten-CUT ▶27 (*Tricensima*). Two ditches and a stone wall with rounded towers surround the nine central *insulae* of the city, an area of c. 400 × 400 m, where the main public buildings were situated. The massive defensive works indicate that it served as a military stronghold, but internal buildings with a clear military character have not been recognised as yet.

Fig. 2.15 Visor of a cavalry helmet found in the northern outlet of the *fossa Corbulonis* just outside the northwest gate of the auxiliary fort of Leiden-Roomburg | Park Matilo ▶5a.

Fig. 2.16 Results of the geophysical surveys carried out at Xanten-Fürstenberg ▶28. Indicated are the fortresses of the Augustan and Claudio-Neronian periods.



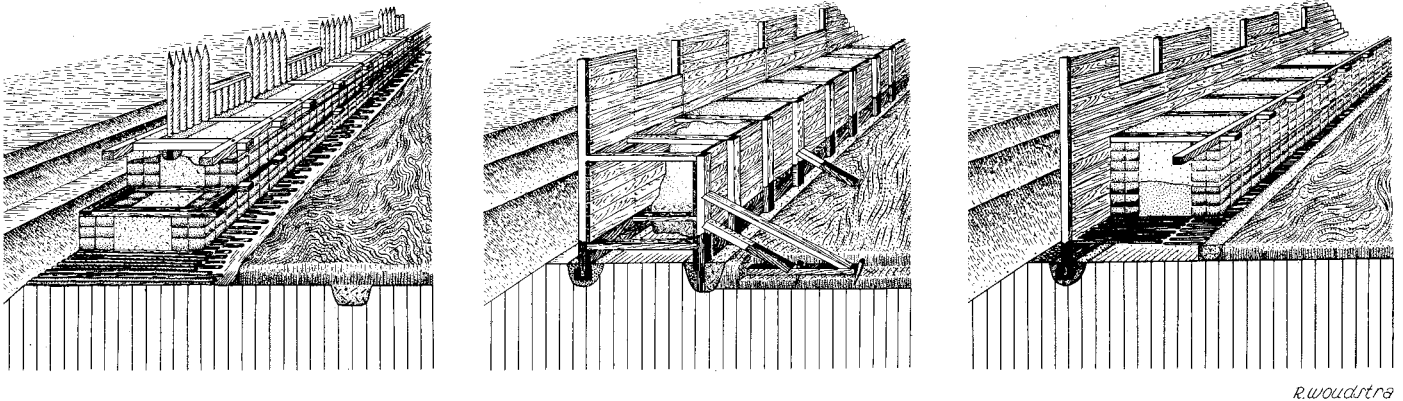


Fig. 2.17 Reconstructions of successive earth-and-timber walls of the Roman fort at Valkenburg-Centrum ►1, phases 1–3 (left to right).

FORTS

From the later 1st century onwards reduced versions of standardised legionary fortresses became common, for the accommodation of regular auxiliary units of nominally 500 and 1,000 men. Sizes of such so-called auxiliary forts typically range from 2–5 ha, depending on the size of the garrison and on whether it included cavalry or not – cavalry needing more space than infantry. Clear examples of such forts can be found at Till ►22, Krefeld-Gellep ►32 and Dormagen ►36.

The final building phase of the fort at Bunnik-Vechten ►11 belongs to the same size range, but its orientation is in keeping with that of the ‘delta type’ forts with only two strips of buildings, instead of the usual three. Of this reduced fort type of 0.9–1.6 ha, Valkenburg-Centrum ►1 is the classic example. Although in the case of infantry a regular unit of 500 men might be squeezed in, the garrisons may well have been smaller, especially if they consisted partly or entirely of cavalry.

The regular and delta type forts were initially built in timber, or occasionally provided with ramparts clad with sods (fig. 2.17). The headquarters buildings were the first to be rebuilt in stone; the defences and other buildings generally followed later. Only the fort at Dormagen ►36 and the cavalry fort which succeeded the legionary fortress of Neuss-Koenenlager ►33 were built in stone from the outset, at the end of the 1st century.

In size the fort at Remagen ►44 belongs to the range of delta type forts, but its form was irregular. Forts of irregular shape are typical of the earlier stages of the frontier. Most of the building phases of Moers-Asberg ►30 belong to this category, of which the fort of Nijmegen-Kops Plateau ►16 is a further clear example. The fleet station of Köln-Alteburg ►39 (cf. below) is of irregular shape as well. Whereas irregular fortresses and forts were as a rule replaced by regular ones at some point in their history, Köln-Alteburg and Remagen kept their irregular form until the very end of their existence, for Remagen as late as the 5th century.

A singular installation is the walled area of c. 250 × 150 m that was marked out in the southern corner of *Colonia Ulpia Traiana* at Xanten ►27 (Süd-quartier), provisionally dated to the 3rd century AD. Although the situation is reminiscent of the reduced forts of the Late Roman period, the size and shape are similar to those of earlier regular auxiliary forts.

Forts of the Late Roman period are characterised by heavy stone walls and large numbers of round towers. The bridgehead fort of Köln-Deutz ►38 (cf. below) is the best preserved example. The fort of Nijmegen-Valkhof ►14 may have had a similar outward appearance. Most Late Roman installations were not new creations, but reductions of previously existing forts, as at Kalkar-Bornsches Feld ►24 and Dormagen ►36. Remagen ►44 stands out in retaining the same size in the Late Roman period as before.

FORTLETS AND TOWERS

Fortlets are military installations in the size range of 0.1–0.5 ha, providing accommodation for detachments from larger military units. This explains why headquarters buildings are missing and most of the internal buildings consist of barracks.

Three military posts can be classified as fortlets, on account of their sizes. The two smallest examples, of Duisburg-Werthausen ►31 (0.17 ha) and Neuss-Reckberg ►34b (0.11 ha) are unlikely to have accommodated more than c. 160 soldiers. The fortlet of Neuss-Reckberg was located on the Limes road, overlooking the winding stretch of the Rhine between Neuss ►33 and Dormagen ►36. The fortlet of Duisburg-Werthausen was positioned in the ‘bottleneck’ of a narrow meander, on the right bank of the river. The massive construction of the fortlet of Haus Bürgel ►35 with its projecting round towers is typical of the Late Roman period (fig. 2.18). Today it is situated on the right bank of the Rhine, but in the Roman period it was located on the left bank of a large meander, perhaps in a position similar to that of Neuss-Reckberg. It is the only military installation on the Lower German frontier with partly standing walls, incorporated into a castle of medieval and later



Fig. 2.18 Aerial view of Monheim-Haus Bürgel ▶35. Parts of Late Roman masonry are still visible in the buildings' facade today.

date. The reduced Late Roman fort at Dormagen ▶36 had similar dimensions.

Watchtowers were the smallest military structures, with their walls rarely exceeding 20 m in length. They could be surrounded by earthen embankments or additional stone walls and by one or two ditches. Given their small size they are extremely difficult to trace. In all, over a dozen towers are known or suspected along the Rhine, but many more may have existed.

Intensive field survey and large-scale excavation have produced a series of five timber watchtowers along a particularly winding stretch of the river between the forts of Utrecht-Hoge Woerd ▶8 and Woerden-Centrum ▶6. It was possible to preserve one of these, at Utrecht-Groot Zandveld ▶9. These are the earliest known watchtowers on the frontiers along the Rhine and the Danube. There are some indications that one or more timber towers in the Utrecht area were succeeded by stone towers. At Neuss-Reckberg ▶34a a stone tower of c. 5 × 5 m has been attested, only 200 m northwest of the fortlet mentioned earlier. Two successive stone towers existed in the dynamic stretch of the Rhine at Xanten-Lüttingen, but these could not be preserved; along with that of the Reckberg they demonstrate that more towers may have occurred at very specific positions in the riverine landscape.

A much more massive stone tower has been attested at Moers-Asberg ▶30, built in the late 4th century AD on the site of the auxiliary fort evacuated at the end of the 1st century. The tower of 18 × 18 m was surrounded by an extra defensive wall of c. 38 × 38 m and by a wide ditch. Installations of this type are often labelled *burgus*, and are common on some other frontier sections. On the left bank of the Rhine it is the only preserved example.

TEMPORARY CAMPS

Temporary camps were standard elements of the Roman military repertoire, constructed for protection for short periods of time. They were built for different purposes, for instance as a shelter during field operations or sieges, in advance of the completion of a permanent base, or just for training. When they were occupied for less than a campaign season the troops will have camped in tents, leaving comparatively few traces. Usually little more than an earthen wall and the surrounding ditch would have remained after the troops left. Today several can still be discerned on the surface.

Accommodation of the troops in tents required much less space than in a permanent base with its solid barracks and additional buildings such as warehouses and workshops. Temporary camps were therefore considerably smaller than permanent ones. On the Lower Rhine nearly 200 temporary camps have been attested so far, most of them in clusters of up to several dozen. Large clusters have been found at distances of a few kilometres from the legionary fortresses of Xanten-Fürstenberg ▶28 and Bonn ▶41. The majority of the camps involved have sizes in the range of c. 0.5–2.5 ha; larger camps of c. 3–5 ha are much rarer (fig. 2.19).

Those temporary (or marching) camps occurring in dense clusters have been further interpreted in their function as manoeuvring camps built for training purposes, similar to clusters outside the legionary bases of Chester and York (UK) or at Strasbourg (FR) and Komárom (HU).

The sizes and arrangement of the camps near Bonn suggest that they are the remains of incidental move-

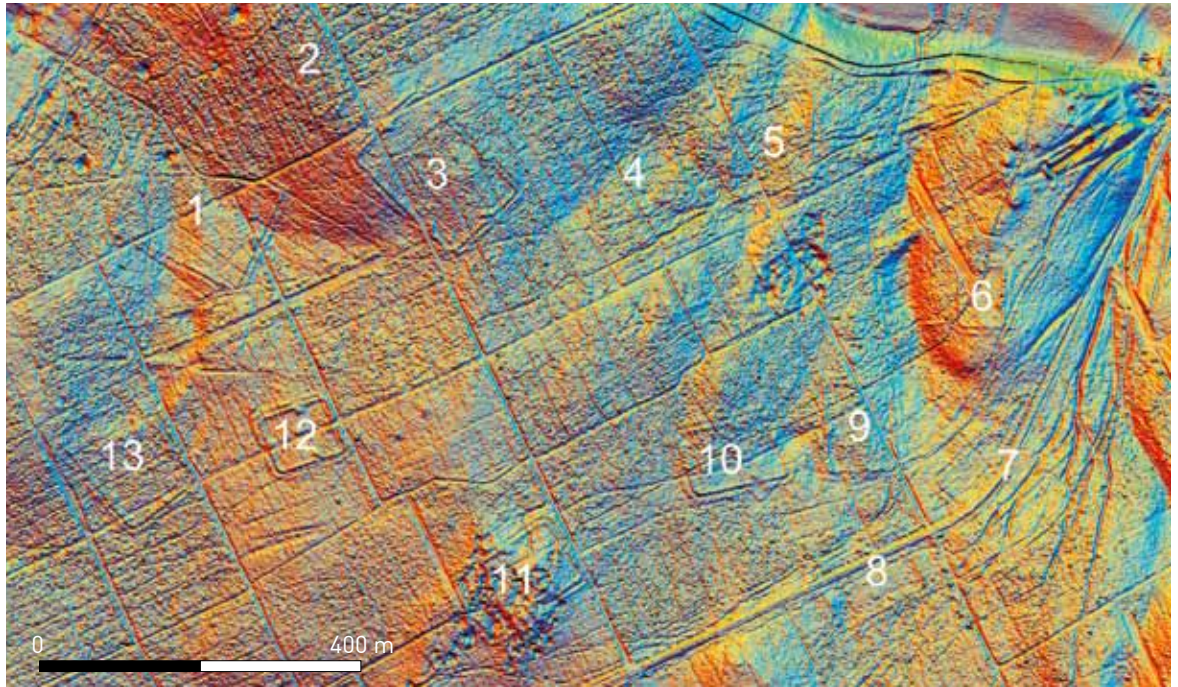


Fig. 2.19 Digital elevation model of the temporary camps at Uedem-Hochwald ►25 (north at top).

ments of a single legion and its associated auxiliary forces, as mentioned in the context of imperial visits in the historical sources. In view of the similar sizes, most of the temporary camps in the vicinity of Xanten are probably manoeuvring camps as well, but the arrangements suggest that these reflect a joint operation of several legions and their auxiliary units. Those of Wesel-Flüren ►26 were located on the right bank of the Rhine, demonstrating that the opposite river bank was claimed for military purposes, confirming literary and epigraphical sources.

A few temporary camps are considerably larger, ranging from c. 10–30 ha, providing space for possibly as

many as 10–30,000 troops. These camps were clearly built for large armies involved in or preparing for a war. In the case of camp B at Till-Kapitelshof ►22 it is clear that it was used for a somewhat longer period than the others, as it was provided with a timber-framed wall. The presence of four to five defensive ditches indicates that it was located in a very hostile environment; it might well be the camp of *Arenacum* mentioned in a description of the Batavian revolt of AD 69/70 in a historical source.

FLEET BASE AND BRIDGEHEAD FORT

The Rhine was used for naval operations from the very start of the Roman occupation of the area. Initially, the fleets were presumably ad hoc flotillas used for exploration and for transport of troops and supplies. A standing fleet may not have existed before the 40s AD. The irregularly shaped fort of Köln-Alteburg ►39 has been identified as the main base of the Roman fleet on the Rhine, on account of the presence of numerous tile stamps mentioning the *classis Germanica* ('German fleet'), and of gravestones and votive altars mentioning fleet personnel (fig. 2.20). As the fort is located on the river terrace, c. 8 m above the water level of the Rhine, the harbour installations must have been located along the river channel, but so far no remains of it have been attested.

The Roman army was very reluctant to build bridges over rivers on external boundaries. All known permanent bridges across frontier rivers date to the Late Roman period, and were secured by heavily fortified bridgehead forts on the opposite river bank.

The Late Roman bridgehead fort of Köln-Deutz ►38 is the only known permanent military post on the

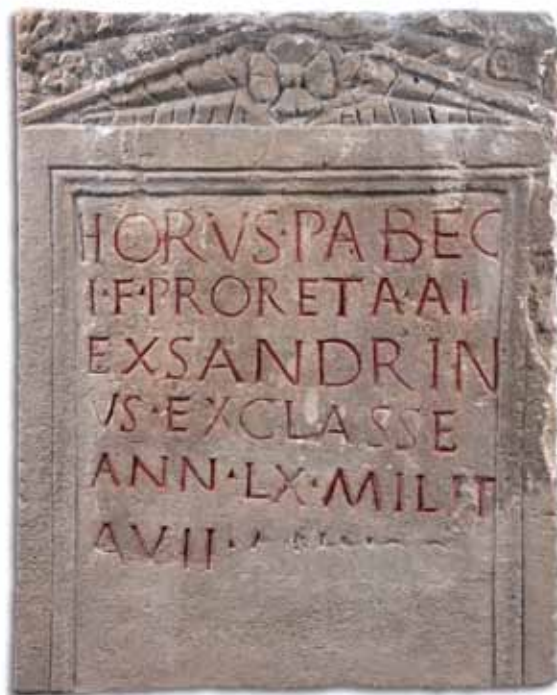


Fig. 2.20 Gravestone of one Horus from Alexandria in Egypt who served in the Rhine fleet ('EX CLASSE') garrisoned in Köln-Alteburg ►39.



Fig. 2.21 Results of the geophysical surveys of the civil settlement (*vicus*) west of the fort of Kalkar-Bornsches Feld ▶ 24.

right bank of the Lower Rhine, serving to protect a permanent bridge. Both fort and bridge were built c. AD 310–315, to permit swift military actions across the Rhine. The fort was a strong square construction of c. 1.8 ha, with an estimated garrison of c. 500–1,000 troops. The 3.3 m thick stone wall was provided with two gates, flanked by rounded towers, and with fourteen additional towers.

CIVIL SETTLEMENTS AND CEMETERIES

Permanent forts and fortresses constituted the cores of much larger agglomerations which included additional military facilities as well as civil buildings. In the case of legionary fortresses these agglomerations are known as *canabae legionis*; those around auxiliary forts are generally called (military) *vici*. These settlements developed as ribbons along the roads leading to and from the fortifications, before expanding laterally.

The largest military facilities known from extramural settlements are exercise halls or *campi* – open training courts which could measure more than 100 × 100 m, surrounded by covered halls and porticoes. At Xanten-Fürstenberg ▶ 28 two to four *campi* have been located recently. An amphitheatre has been known for much longer here, and amphitheatres are known from extramural settlements elsewhere. Bath houses occur in both *canabae legionis* and military *vici*, quite often immediately outside one of the fort gates, as at Utrecht-Hoge Woerd ▶ 8 and probably Bunnik-Vechten ▶ 11.

The extramural settlements provided accommodation for a wide variety of non-combatants, including soldiers' families, artisans and merchants. Such remains are known from Valkenburg-Woerd ▶ 2 and are doubt-

less hidden in the extramural areas of sites like Leiden-Roomburg ▶ 5, Utrecht-Hoge Woerd ▶ 8, Bunnik-Vechten ▶ 11 and Kalkar-Bornsches Feld ▶ 24 (fig. 2.21).

The deceased were buried outside the settlements, along the main roads or elsewhere in the periphery. For most of the Roman period the dead were cremated; the burnt remains were buried in pits, often ac-

Fig. 2.22 Glass vessels from a cremation burial uncovered in Moers-Asberg (*Asciburgium*).



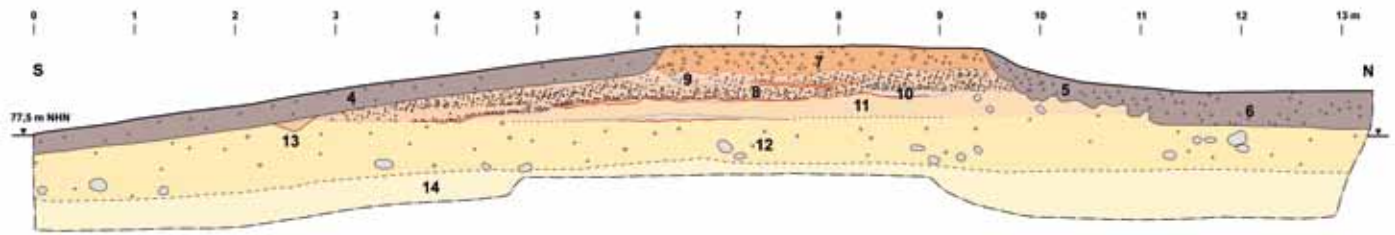


Fig. 2.23 Cross-section of a Roman road near Kleve-Reichswald ▶21 with the different layers of its substructure visible (nos 7–10).

accompanied by pottery, brooches and other personal objects. On the surface the graves might be marked by gravestones or larger stone monuments; on the Lower Rhine circular and rectangular ditches occur as grave markers, with or without low mounds inside them. Burials are among the most difficult features to trace by means other than (destructive) excavation (fig. 2.22), which explains why the presence of unexcavated parts of cemeteries is only attested for some of the larger clusters of component, as with Kalkar-Bornsches Feld ▶24.

LIMES ROAD

‘Limes road’ is the convenient name for the road which connected the military installations along the external frontiers of the Roman Empire. On the Lower Rhine the road typically consisted of an embankment 6–15 m wide, metalled with thick layers of gravel and flanked by drainage ditches, as at Kleve-Reichswald ▶21 (fig. 2.23). Where the road was exposed to flooding, however, the embankment was consolidated by rows of posts, in some cases clad with planks and connected by tie beams, as at Utrecht-Balije ▶7c. The earliest section of the Limes road on the Lower Rhine was between Köln and Trier on the river Mosel-

le, constructed in or soon after 17 BC. Its northward extension as far as Xanten appears to date from the very beginning of the 1st century AD. Downstream from Bunnik-Vechten, however, the Limes road seems not to have been built before the 80s of the 1st century. This explains why the forts of Utrecht-Hoge Woerd ▶8 and Utrecht-Domplein ▶10 were not on the line of the Limes road, but connected to it by branch roads, since the main road by-passed the large meanders on which these forts were located.

KILN SITES

One of the largest known facilities for lime production in the Roman Empire is situated at Iversheim ▶43. Six kilns with a workshop and other buildings illustrate the process of converting local limestone into quicklime for building purposes, up to 200 tons per month. Inscriptions demonstrate that this facility was operated by the legion stationed at Xanten. The army also produced huge quantities of ceramic roof and floor tiles, conduits and elements for heating systems. Initially the kiln sites were spread out over the frontier zone, but from the early 2nd century onwards the manufacture was concentrated at Berg en Dal-Holdeurn ▶18, a production unit set up in the



Fig. 2.24 Tableware and coarse pottery made by and for the *legio X* stationed at Nijmegen.



Fig. 2.25 The remains of the Roman earthworks at Bergen Dal-aqueduct ►17 are still clearly visible in the landscape today.

late 1st century by the legion stationed at Nijmegen. Several kilns and buildings illustrate the enormous scale of production. In the early stage of its existence the kiln site was used for the manufacture of pottery as well (fig. 2.24).

AQUEDUCT

Aqueducts are well known in the context of water supplies to cities, but they have also been attested near legionary fortresses. The water demand of such bases may well have amounted to five million litres a day, not accounting for demand within extramural settlements and for industrial activities. It may not have been easy to supply such volumes from wells and from cisterns collecting rain water.

The legionary fortress of Nijmegen-Hunerberg was served by the aqueduct of Bergen Dal-aqueduct ►17. Collecting water from natural sources and aquiferous strata it ran over a distance of 5.5 km, cutting through a low hill and bridging three valleys (fig. 2.25).

TOWNS AND GOVERNOR'S PALACE

In the Lower German frontier zone towns developed very slowly. In the 1st century AD ribbon development seems to have prevailed over the classic chequerboard layout known from towns in the interior of the Empire. It took strong imperial encouragement and military assistance in the early 2nd century to provide the district capitals of the Lower German frontier with the types of monumental public buildings normally financed by the urban elite. It was only then that these towns developed an internal structure with square *insulae* (blocks of houses) (fig. 2.26); sooner or later

the towns were provided with a wall and ditch. At Xanten-CUT ►27 a fort was built inside the city wall in the 3rd century. In the late 3rd or early 4th century the entire city was reduced to a military stronghold covering the nine central *insulae*.

The provincial capital of Köln underwent a more prosperous development, due to its promotion to a *colonia* by AD 50 and to the presence of the headquarters of the commander of the Lower German army, which served as the seat of the provincial governor after the creation of the province of Lower Germany c. AD 85. The *praetorium* or governor's palace was situated on the river front at Köln, clearly visible from the opposite bank. The building was repeatedly enlarged and rebuilt until it occupied as much as four *insulae* of c. 100 × 100 m each. The palace served several times as the residence of emperors and usurpers.

SANCTUARIES

In the Lower Rhineland, monumental temples were first introduced in the Roman period, succeeding the open air sanctuaries of the Iron Age. Most temples belong to the so-called Gallo-Roman type, characterised by a high *cella* (cult room) surrounded on all four sides by a *porticus*. Although it is likely that most temples were dedicated to a single deity, they attracted dedications to other gods and goddesses as well. Classical deities from the Greek-Roman pantheon were regularly identified with regional deities, resulting in mixed creations such as Hercules Magusanus, which was particularly popular amongst soldiers.

It has been claimed that this god was venerated in the Gallo-Roman temple of Elst-Grote Kerk ►13, but



Since the Rhine was the easiest way to supply the military infrastructure with heavy and bulk goods, it is likely that all fortifications along the river channel were provided with mooring facilities of some kind. In their most elementary form they could consist of simple rows of posts along the river channel, as at Leiden-Roomburg, or of revetments locked behind heavy uprights, as at Bunnik-Vechten. More elaborate constructions away from the main river course, as attested at Xanten-CUT and Voorburg-Arentsburg, may be described as harbours (fig. 2.28).

The importance of waterborne supply explains why great pains were taken to maintain access to the river channel if it migrated away from the military installation. In such cases new rows of posts or revetments were constructed out into the receding river channel, backfilling the intermediate space with soil, brushwood and settlement waste. Excavations at Bunnik-Vechten have demonstrated that the river bank was built out as far as 60 m.

When the river migrated away from the military settlement, waste dumped into the river channel was no longer washed away but instead covered with sedi-

ment. In this way layered waste deposits were gradually built up which provide a detailed image of everyday life on the frontier over time. Such deposits have been attested at several sites, from Kalkar-Bornsches Feld ▶24 to Leiden-Roomburg ▶5.

Ship wrecks first of all reflect the key importance of rivers for the transport of troops and supplies. Excavations at Alphen aan den Rijn-Zwammerdam (table 2.1), Woerden-Centrum ▶6 and Utrecht-Balijs ▶7c have further demonstrated that occasionally ships were deliberately sunk to serve as a foundation for a quay or as protection against erosion of the river bank. Ships may therefore be part of the built riverine infrastructure as well as providing evidence of transport and supply. The component parts of *Frontiers of the Roman Empire – The Lower German Limes* include remains of at least two ships: a patrol craft at Bunnik-Vechten ▶11 and a cargo ship at Utrecht-Balijs ▶7c. A geophysical survey suggests that there may be another ship still intact at the latter site, and given the large numbers of ships found so far, it is very likely that more ships are hidden in other component parts (fig. 2.29).

Fig. 2.28 Timber structures of the harbour of Xanten-CUT ▶27 during excavation.

Fig. 2.29 Frame saw (a) and block plane (b) recovered from a Roman cargo vessel excavated at Utrecht-Limes road | Balijs ▶7c.

Table 2.1 Brief description of elements of *Frontiers of the Roman Empire – The Lower German Limes*. The elements included in the nomination are preceded by the number of the component part used throughout this study. Elements without a number (shaded) have been rejected.

id	name	brief description
---	Katwijk-Brittenburg	Auxiliary fort. At various times in the 16 th and 17 th centuries the remains of a stone fort have been observed on the beach of the North Sea during extremely low tide. A drawing made c. 1560 and several illustrated and collected finds seem to confirm that the remains belong to a Late Roman fort, presumably with an earlier predecessor. Despite repeated efforts it has not been possible to establish the location of the fort. For this reason the site was not included in the nomination.
---	Katwijk-Uitwateringssluus	Civil settlement. During the construction in the 1980s of a new lock regulating the outflow of the Rhine into the North Sea, several Roman finds and features were excavated which were thought to be remains of the military <i>vicus</i> belonging to the presumed fort of the Brittenburg (cf. above). The excavation was very limited and although, in view of its location, the interpretation of the features as part of a military complex is plausible, the extent of the settlement is unclear and the modern setting makes sustainable protection of any remaining features impossible.
1a	Valkenburg-Centrum Kerkweg	Auxiliary fort. The fort at Valkenburg-Centrum was built on the western bank of the Roman Rhine, close to its estuary, immediately bordering the river channel. The fort is the best known example of the 'delta type' with two ranges of internal buildings instead of three. It is thought that six successive forts were occupied from c. AD 40 until 270, with initially timber and later stone building phases. Some finds from the Late Roman period suggest activity in the period AD 270–450. The preservation of the timber remains is especially good, but parts of the stone walls were also found standing to a height of 50 cm, which is rare in the delta. The site has been investigated through large-scale excavations, but parts of the fort remain in the ground, and the preservation of organic material continues to be excellent. Although the northeast corner of the fort was eroded by the Rhine in the Middle Ages, the state of preservation of both timber and stone remains and the attested longevity of the fort justify the site's inclusion in the nomination. Component part 1a includes the unexcavated north-western corner of the headquarters building. This main building of the fort was situated at the same location within the fort throughout all the building phases.
1b	Valkenburg-Centrum Centrum	For a general description cf. component part 1a. Component part 1b includes various parts of the fort: most of the two main roads within the fort, the northwest part of the headquarters building, sections of the defensive structures throughout all the building phases, parts of the commander's quarters from the earliest phase and parts of infantry and cavalry barracks from successive phases.
1c	Valkenburg-Centrum Raadhuis	For a general description cf. component part 1a. Component part 1c, located in the northeast corner of the fort, includes the remains of cavalry barracks from the earliest building phase and of large buildings from subsequent phases.
1d	Valkenburg-Centrum Kerkhof	For a general description cf. component part 1a. Component part 1d, located in the southwest corner of the fort, encompasses part of the defensive structures of the fort throughout the different building phases.
2a	Valkenburg-De Woerd North	Civil settlement, Limes road, quays. The civil settlement of Valkenburg-De Woerd is the best known example of a military <i>vicus</i> in the Rhine delta, which is one of the main reasons for its inclusion in the nomination. Habitation started around AD 50 and lasted until the middle of the 3 rd century AD. The layout and finds assemblage indicate that the site was an extra-mural civil settlement connected to a fort, but its association with the fort of Valkenburg-Centrum ► 1, situated c. 1 km north of De Woerd, is not clear. The settlement consisted of strip houses stretching out along the Limes road. The houses were built on an artificially raised platform, necessitated by the wet conditions near the estuary of the Rhine. The rows of posts lining the Limes road, the heavy posts of quays and rows of posts along the river bank, all well-preserved, were also a response to these conditions. Component part 2a holds evidence for a bend in the Limes road, probably because the earlier straight course had been washed away by the river. Just south of this bend, traces of a channel connected to the Roman Rhine have been discovered. It is likely that a bridge or similar structure had to be constructed here to carry the main course of the Limes road.
2b	Valkenburg-De Woerd South	For a general description cf. component part 2a. Component part 2b contains the remains of rows of posts lining the river bank and of parallel series of heavy posts indicating the presence of quays. The Limes road continues in a straight line through this southern component part, with strip houses aligned to it. About halfway through, the course of the Limes road crosses a watercourse connected to the Roman Rhine. It has been shown that the road in this area had at least two phases, with the latest phase dated to AD 123/125.
3	Voorburg-Arentsburg	Town, harbour. The civil town of <i>Forum Hadriani</i> owed its existence largely to the 2 nd -century emperor Hadrian. It was a very late creation in the frontier zone, meant to serve as the administrative centre of the tribal area of the Cananefates. The built-up area of the town was divided into rectangular blocks of irregular size and shape. The town houses and other buildings were mostly built in timber, but stone buildings stood in the centre of the town, including a large bathhouse. The surface area of the town lay between 9 and 14 ha, varying between building phases. At some point the town was enclosed by a stone wall and a double ditch. The finds assemblage from the town has some particular military characteristics, suggesting that the town played a part in the supply of the army. In AD 160 a natural channel within the town area was transformed into a harbour through the construction of timber revetments and quays. The harbour was connected to Corbulo's canal ► 4, allowing transport to the Rhine frontier in the north as well as to the estuary of the Meuse and Waal to the south, and to that of the Scheldt still further south. In the early 3 rd century AD repairs were made to the harbour quays. Habitation ended in the early 4 th century at the very latest. The site is relatively well preserved. The excavations in the early 19 th and 20 th centuries in parts of the town were only partly destructive. Because of the level of preservation and the assumed military connection of this civil town with its harbour, the site of Voorburg-Arentsburg has been included in the nomination.

id	name	brief description
4a	Corbulo's canal Vlietwijk	<p>Canal.</p> <p>The existence of a man-made canal between the Oude Rijn near Leiden-Roomburg ► 5 and the river Meuse southwest of Naaldwijk has been established in several locations. So far the canal, which connected two natural channels, has been attested over a distance of 11 km, being on average c. 12–14 m wide and c. 1.5–2.0 m deep. Nearly everywhere the sides of the canal were consolidated with rows of timber posts, which are well preserved. There is also evidence for further reinforcement of the sides through the use of wattle between the timber revetments and the application of clay sods.</p> <p>This man-made canal can be equated with the historically attested canal dug over a distance of 23 Roman miles by soldiers under supervision of the army commander Corbulo in AD 47. The favourable conditions for the preservation of timber have allowed the establishment of felling dates as precise as the spring of AD 50. Man-made canals are a rare category on their own account, but Corbulo's canal stands out because of its preservation and historical context.</p> <p>Component part 4a is the most northerly of six component parts covering the 11 km stretch along which the canal has been attested. At Vlietwijk, the canal seems to have been dug into a largely silted-up natural tidal channel.</p>
4b	Corbulo's canal Starrenburg	<p>For a general description cf. component part 4a.</p> <p>Component part 4b is the northerly of three component parts (4b–d) where excavations have established the course of the canal. Here it has been dug through peat.</p>
4c	Corbulo's canal Knippolder	<p>For a general description cf. component part 4a.</p> <p>Component part 4c is the middle of three component parts (4b–d) where excavations have established the course of the canal. The canal has been dug through peat at Knippolder. In addition, natural creeks have been discovered next to the canal. The canal seems to have taken a turn inland at this location.</p>
4d	Corbulo's canal Vlietvoorde	<p>For a general description cf. component part 4a.</p> <p>Component part 4d is the southerly of three component parts (4b–d) where excavations have established the course of the canal. The canal has been dug through peat at Vlietvoorde. At this location the course of the canal seems to have shifted in its second phase. On the eastern side there are traces of an earlier natural creek.</p>
4e	Corbulo's canal Rozenrust	<p>For a general description cf. component part 4a.</p> <p>Component part 4e holds traces of a second, possibly natural creek next to the canal.</p>
4f	Corbulo's canal Romeinsepad	<p>For a general description cf. component part 4a.</p> <p>Component part 4f is the most southerly of six component parts covering the 11 km stretch along which the canal has been attested. Here the width of the canal has been established as 14 m. Following the course of the canal in the direction of the Meuse, it appears that not far outside the component part the canal bent away to the west, crossing a coastal barrier.</p>
5a	Leiden-Roomburg Park Matilo	<p>Auxiliary fort, civil settlement, harbour installations, riverine waste deposits.</p> <p>The site of Leiden-Roomburg holds the remains of a military complex centred on an auxiliary fort of the 'delta type', built at the junction of the river Rhine and a tributary river c. AD 40/50. This natural channel was connected to the town of Voorburg-Arentsburg ► 3 and to the river Meuse further south by Corbulo's canal ► 4. The fort was evacuated in the 3rd century AD, but finds indicate some activity in the later 3rd and 4th centuries.</p> <p>The well-preserved timber revetments and quays along the natural channel are part of the nominated complex, as are the riverine waste deposits containing a wealth of organic remains. The site also includes many remnants of the extra-mural civil settlement, the periphery of which has been found in excavations. The fort itself has been excavated only to a very limited extent; consequently, practically nothing is known about the fort's interior. The limited scale of excavation, the favourable conditions for preservation of organic remains and the presence of several key values of the Lower German Limes justify the inclusion of this site in the nomination.</p> <p>Component part 5a includes the unexcavated parts of the civil settlement surrounding the fort and extending along the southern bank of the natural channel. To the east, part of the bank of the Rhine is included. The extent of the civil settlement has been attested by coring and trial trenches. Its precise lay-out, however, remains unknown. The component part is likely to include roads leading to the west and south.</p>
5b	Leiden-Roomburg Besjeslaan	<p>For a general description cf. component part 5a.</p> <p>Component part 5b includes unexcavated parts of the extra-mural civil settlement south of the fort. The boundaries of this settlement have been established by coring and trial trenches, but the lay-out is otherwise not known. The component part is likely to include a road leading to the south, possibly lined with burials.</p>
--	Limes road Alphen aan den Rijn West	<p>Limes road.</p> <p>On account of coring surveys the presence of the Limes road was expected at various locations between Alphen aan den Rijn and Zoeterwoude-Rijndijk. Its existence has been confirmed in two trial trenches, but the preservation was not sufficient to include the section in the nomination.</p>
--	Alphen aan den Rijn-Hoorn	<p>Limes road (?), fortlet (?), watchtower (?).</p> <p>Markers for Roman roads have been identified at several locations within the Hoorn area, but the course of the Limes road could not be securely established. A concentration of pottery fragments and the presence of wooden posts might relate to the presence of a fortlet or watchtower, but this identification remains uncertain. The site is therefore not included in the nomination.</p>
--	Alphen aan den Rijn-Centrum	<p>Auxiliary fort, civil settlement, riverine waste deposits.</p> <p>The auxiliary fort of Alphen aan den Rijn, belonging to the 'delta type', was almost completely excavated in c. 2000 (with nothing preserved). At the same time a considerable proportion of the waste deposits in the former riverbed was investigated. It is likely that significant parts of the extra-mural civil settlement still remain, but their extent and layout remain unclear. This site has therefore not been included in the nomination. All aspects of the site are better represented elsewhere.</p>

id	name	brief description
---	Alphen aan den Rijn-Goudse Rijkpad	Watchtower (?). The number and character of surface finds collected here and the location along the Limes road have often been taken as indications of the presence of a small military post, possibly a watchtower. Despite several surveys and a limited excavation, this hypothesis has not so far been confirmed, but watchtowers are very difficult to locate. On the basis of the evidence currently available, it is not possible to include the site in the nomination.
---	Limes road Alphen aan den Rijn East	Limes road. On account of coring surveys the presence of the Limes road was expected at various locations between Zwammerdam and Alphen aan den Rijn. Its existence was confirmed in one of two trial trenches, but the preservation was not sufficient to include the section in the nomination.
---	Alphen aan den Rijn-Zwammerdam	Auxiliary fort, civil settlement, riverine waste deposits, ships. At Zwammerdam an auxiliary fort was completely excavated in c. 1970 (with nothing preserved). It can be classified as a 'delta type' fort. A large segment of the adjacent riverine waste deposits has been excavated as well, together with the remains of six ships from the Roman period. Parts of the extra-mural civil settlement are probably still preserved, but its extent and layout are unclear. Because of the near complete destruction of the fort and the fragmentary knowledge of the remaining elements of the civil settlement, the site is not included in the nomination. All aspects of the site are better represented elsewhere.
---	Bodegraven-Centrum	Auxiliary fort (?). In the town centre of Bodegraven some remains of a small timber military installation have been attested, built in the mid-1 st century AD. The size and shape of the fort have yet to be determined – it may have been a small fort of the 'delta type' or an even smaller installation. In two locations well-preserved timber has been uncovered. The finds assemblage indicates military activity starting around the middle of the 1 st century AD and probably extending into the 2 nd or 3 rd century. In 2018 efforts were made to establish the extent of the fort by geophysical research and a trial trench, but neither method proved successful. Currently there are no other locations available through which to assess the size and form of the fort. In the absence of any further evidence it is impossible to include the site in the nomination. Should future research be more successful and provide further evidence of good preservation of timber and other organics, consideration may be given to include the fort through a proposal for a minor boundary modification.
---	Limes road Woerden-Bodegraven	Limes road. On account of coring surveys the presence of the Limes road was expected at various locations between Woerden and Bodegraven. Its existence seemed to be confirmed in three of six trial trenches, but the preservation was not sufficient to include the section in the nomination.
6	Woerden-Centrum	Auxiliary fort. The town centre of Woerden is built on the remains of an auxiliary fort of the 'delta type'. It was situated on the southern bank in a bend of the Roman Rhine. The fort was founded in the early 40s AD and initially built of earth and timber. The first phase of the fort has an orientation differing from that of the later ones and knowledge of it is very incomplete. Part of it appears to be buried beneath the rear section of the later forts, and is therefore included in the nominated property. In the late 2 nd century the rampart and some inner buildings were rebuilt in stone. The interiors of the successive forts remain largely unexcavated; only some sections of timber buildings and a small section of stone wall have been attested. The fort seems to have been evacuated or abandoned in the 3 rd century, but the levels from this period are not well preserved.
---	Limes road Harmelen-Woerden	Limes road. On account of coring surveys the presence of the Limes road was expected at several locations between Harmelen and Woerden. Its existence was confirmed in only one of three trial trenches and the preservation was not sufficient to include the section in the nomination.
7a	Utrecht-Limes road Zandweg	Limes road, watchtowers, ship. West of the fort of Utrecht-Hoge Woerd ► 8 a c. 2.5 km long section of the Limes road was traced along the southern edge of three large meanders of the Rhine. Initially, from the mid-1 st century AD onwards, the river bends were protected by timber watchtowers. The Limes road was built later, probably in the 80s AD. Like all other known sections of the Limes road in the western delta, it was rebuilt in AD 99/110 and 123/125, presumably following personal inspection by the emperors Trajan (AD 98–117) and Hadrian (AD 117–138). The foundation of the road consisted of an earthen embankment 10 m wide on average, but the road itself appears not to have been wider than c. 5 m. The embankment was consolidated either immediately or very soon after construction with rows of timber posts; on the river side of the road in some places and on both sides in others. In some sections these rows of posts were clad with planks on the inner side, to reduce the lateral pressure of the soil. The revetments on either side were occasionally linked with tie beams. The watchtowers and roads were constantly threatened by erosion from the shifting river bends. Particularly vulnerable sections of the river bank were consolidated by revetments, and in one case by the deliberate sinking of a large cargo ship. The road section represented by component parts 12a–c is likely to be characteristic of much of the section between the military complex of Bunnik-Vechten ► 11 and Harmelen (further west), as various small excavations in the built-up area of the municipality of Utrecht have demonstrated. Between Harmelen and the North Sea coast the course of the Limes road is often less certain and the integrity of the attested remains frequently does not meet the standards required for nomination (cf. several records below). Because the well-preserved road section in Utrecht is located in an area with high development pressure (urban, infrastructure), the potential for sustainable protection is limited. The three component parts 12a–c constitute a small but high-quality example of the Limes road in the Rhine delta.

id	name	brief description
		Component part 7a is the most westerly of the three component parts. Here, three phases have been identified in the construction of the Limes road. The surrounding ditch of an excavated timber watchtower is still partly preserved under the edge of the Limes road. Buried remains of a Roman ship may still lie in the former riverbed.
7b	Utrecht-Limes road Veldhuizen	For a general description cf. component part 7a. Component part 7b is the middle of the three component parts. Excavations have shown that here the initial road revetment was replaced between AD 91 and 100 because of erosion caused by river activity. The length of the revetment, at least 70 m, indicates that this must have been a large-scale water management project.
7c	Utrecht-Limes road De Balije	For a general description cf. component part 7a. Component part 7c is the most easterly of the three component parts. The earliest phase of the Limes road was found here to post-date the ditch of a watchtower. The road was twice damaged by the Rhine, in spite of its consolidation by timber revetments and basalt blocks. Further evidence for erosion comes from a c. 35 m long cargo ship which was deliberately sunk around AD 100 to consolidate the revetments. This ship is still largely preserved underground. Some 50 m further east the earlier of two 1 st -century watchtowers is partly preserved.
---	Utrecht-Meerndijk	Dug canal (?). A water channel attested below a dike named the Meerndijk has been taken as a partly artificial connection between the Rhine near Utrecht-Hoge Woerd ►8 and the Hollandse IJssel further south. It is, however, a matter of discussion whether it was a natural connection or partly artificial. Since the supposed artificial water channel is situated below the dike, further investigation is not possible. In the absence of conclusive evidence this site was not included in the nomination. Corbulo's canal ►4 further to the west is a well-attested example of a dug canal.
---	Utrecht-Touwslagerslaan	Watchtower (?). On account of finds of pottery and a sling shot, this site has been in the past considered as a possible watchtower. In view of recent new insights into the relationship between the locations of watchtowers and the course of the Rhine in this area, this is no longer considered likely.
8a	Utrecht-Hoge Woerd Castellum	Auxiliary fort, civil settlement, cemetery, riverine waste deposits. The Hoge Woerd area encompasses a succession of 'delta type' forts, most of the extra-mural civil settlement, parts of the cemeteries, a 400 m long stretch of the Roman Rhine channel in front of the forts, and roads departing in three directions. The fort was occupied c. AD 40–275. Coins from the 4 th century reveal some later activity. This site is one of the few fairly complete examples of the whole of a military complex, including its riverine rubbish deposits. The fort area is relatively untouched by later building and by excavation. The remains of the extra-mural settlement include the lower walls of a stone bathhouse. The silted-up river channel has yielded rich and layered deposits of settlement waste. In addition, it may well hide the remains of one or more ships. Component part 8a includes the larger part of the complex. All the key elements listed above are represented in this component part.
8b	Utrecht-Hoge Woerd Langerakbaan	For a general description cf. component part 8a. Component part 8b includes traces of the extra-mural settlement to the north and east of the fort and part of a Roman cemetery.
9	Utrecht-Groot Zandveld	Watchtower. The site holds the remains of a timber watchtower, which stood on a sandy ridge c. 1 m high on the south bank of the Roman Rhine. Its ground plan comprises four timber uprights delineating a square of 3 m × at least 2.8 m. The watchtower was surrounded by at least two ditches. The installation appears to have been built in the mid-1 st century AD, but was probably in use for only 10–20 years. In the 3 rd century AD the river migrated rapidly to the northwest. There are indications that the watchtower may have been succeeded at that time by a somewhat larger military installation, perhaps a fortlet, situated nearer to the new river channel. The remains of the timber watchtower are still largely intact. This is a rare situation since watchtowers are usually only detected during excavation, causing destruction of most or all of the remains. The tower is representative of a series of (excavated) towers which were located along a particularly winding stretch of the Rhine, revealing the critical importance to the Roman military of ensuring close observation of the river channel.
---	Utrecht-Duitse Huis	Cemetery. In view of its proximity to the fort of Utrecht-Domplein ►10 it is likely that this cemetery, attested by excavation, was part of the military complex. It is largely built over and it is uncertain whether much more of it remains.
10	Utrecht-Domplein	Auxiliary fort. The Domplein fort, measuring c. 125 × 150 m at its greatest extent, was built on the southern bank of the Roman Rhine, directly on the river channel. It belongs to the 'delta type', of which it is the largest known representative. Although parts of the successive headquarters buildings and of some of the surrounding buildings have been uncovered, most of the fort's interior is untouched. Founded in the 40s AD, the fort was probably evacuated in the 3 rd century. Some Late Roman finds seem to indicate military activity in the period AD 270–450, but there are no known defensive structures from that phase. The very limited extent of excavation and the good preservation of timber and stone remains justify its inclusion in the nomination.

id	name	brief description
11a	Bunnik-Vechten Marsdijk	<p>Auxiliary fort, civil settlement, cemetery, Limes road, quays, riverine waste deposits, remains of a ship.</p> <p>Vechten is the earliest and largest military site in the western Netherlands, located on the south bank of a now silted-up channel of the Rhine. It was occupied from c. 5 BC to AD 275; finds indicate some later activity, in the 4th century AD. In its final building phase, the fort had the standard three ranges of internal buildings, but it shared the orientation of the 'delta type' forts, with the long front facing the river. The final, stone-built fort was preceded by a series of earth-and-timber forts.</p> <p>With the attested remains of a series of forts of various sizes, a large extra-mural civil settlement and parts of cemeteries it constitutes a fairly complete example of all aspects of a military complex. This includes rubbish deposits in the Roman Rhine channel running in front of the fort. Initially, timber revetments protected the river bank against erosion. However, when the river channel in front of the fort was cut off by a new meander, the river bank was gradually built out by constructing quays and revetments closer to the channel. Part of a military patrol vessel is still buried in the silted-up river bed, and it is possible that other ships are buried here.</p> <p>An excavation 1 km southeast of the nominated property attests the course of the Limes road in its building phase of AD 123–125. It may reasonably be assumed therefore that parts of the Limes road are present in the nominated property as well.</p> <p>Component part 11a includes most of the military complex. It includes all the key elements listed above.</p>
11b	Bunnik-Vechten Provincialeweg	<p>For a general description cf. component part 11a.</p> <p>Component part 11b is a small part of the civil settlement, situated c. 1 km to the northeast of the Roman fort, showing that the extra-mural settlement stretched over a distance of about 1.5 km along the channel of the river Rhine.</p>
---	Bunnik-Schoudermantel	<p>Watchtower (?).</p> <p>Allegedly, the presence of a watchtower was attested here during construction works on the A12 motorway, but there is no proper documentation for this. Since any remains were destroyed during the works, it has not been included in the nomination.</p>
---	Limes road Wijk bij Duurstede-Bunnik	<p>Limes road.</p> <p>The region between Wijk bij Duurstede and Bunnik-Vechten ▶11 is the most easterly area of the Netherlands where remains of the Limes road have been attested. Further east, between Wijk bij Duurstede and Herwen-De Bijland ▶19, there is only a general idea of its former course, on account of the geological context of the road further west. The landscape between Wijk bij Duurstede and Bunnik-Vechten is defined by three more or less parallel stream ridges of the Rhine, which successively developed from the Bronze Age until the Late Iron Age. The Limes road must have followed one of these ridges. Archaeological surveys in the past few decades have indicated several possible remains of roads, but the presence of the Limes road was not confirmed in a targeted campaign in the early 2000s. In 2013 the Limes road was clearly identified in an excavation close to the military complex of Bunnik-Vechten ▶11, but its further course to the southeast is still difficult to determine. For this reason this section of the Limes road was not included in the nomination. Several rural settlements in the area may have been situated on the Limes road, but there are no firm indications of any association with the military infrastructure.</p>
---	Rijswijk-Roodvoet	<p>Auxiliary fort (?).</p> <p>The finds from quarry pools near the former Roodvoet brick works at Rijswijk had been taken to represent the remains of an eroded fort. The discovery of fragments of three helmets contributed considerably to this assumption. However, the overall assemblage of finds collected during the dredging works is not conclusive. About one third of the collected pottery fragments are medieval or later in date, clearly indicating that the dredged finds do not constitute a homogeneous assemblage. Moreover, the Roman pottery fragments comprise considerably more handmade pottery than is normal for a military site, which casts severe doubts on the presumed military character of the settlement from which they originate. Although a location near the bifurcation of two Rhine branches would make perfect sense for a fort, the finds assemblage cannot be safely interpreted as such. The site is therefore not included in the nomination. The category of eroded forts is adequately represented Arnhem-Meinerswijk ▶12 and Herwen-De Bijland ▶19.</p>
---	Maurik-Eiland van Maurik	<p>Auxiliary fort.</p> <p>Dredging activities in the early 1970s have yielded a large number of Roman finds. Most are dated to c. AD 70–275, but they also include a finds assemblage from the 4th century. The dredging activities were hindered by the presence of concentrations of massive stones at considerable depth. The occurrence among the finds of over 130 tiles stamped by military units supports the assumption that the assemblage represents an eroded fort. So far, however, it has not been possible to attest the presence of any intact remains. As the category of eroded forts is adequately represented Arnhem-Meinerswijk ▶12 and Herwen-De Bijland ▶19, the site has not been nominated.</p>
---	Amerongen-'t Spijk	<p>Military post (?).</p> <p>Large-scale quarrying of sand and gravel has produced large numbers of finds from a period ranging from the Late Iron Age to the Late Middle Ages. They include Roman pottery and building debris and several finds with a military association, including a fragment of a Roman helmet. On account of the helmet it had been thought that the Roman finds represented the eroded remains of a small military post (watchtower?) once positioned on the right bank of the Rhine. However, recent geological research indicates that the findspot was located on the left bank in the Roman period. If the finds actually originate from a military post, its position cannot be established. Due to the uncertain character and location of the site, it was not included in the nomination.</p>

id	name	brief description
---	Kesteren-Prinsenhof	Auxiliary fort (?), cemetery. Excavations in the Prinsenhof area have attested the presence of a cemetery, with several horse burials preceding human cremation burials. There are various indications that this cemetery belongs to a (mainly or entirely) eroded fort which was located to the north or northwest of the cemetery. As the known remains of the cemetery have been excavated (with nothing preserved), it has not been included in the nomination.
---	Randwijk	Auxiliary fort (?). Situating about halfway between Driel-Baarskamp (previous) and Kesteren-Prinsenhof (next) the area of Randwijk is generally considered as a possible location for a military post. It is situated on a wide pre-Roman stream ridge which provided a north-south land connection between the rivers Rhine and Waal, opposite two access routes into Germanic territories to the north of the Rhine. There are three findspots in the region which have produced some Roman finds with a military character, but always alongside pre- and post-Roman material. The presence of some Roman military finds is a general phenomenon on rural sites in the Dutch river area. Without additional evidence therefore, none of the three findspots at Randwijk can be interpreted as a military settlement.
---	Driel-Baarskamp	Military post (?). The hypothesis of an early military installation at Driel-Baarskamp is based on a dozen Early Roman finds and on its location at the presumed junction of a regional road with the Limes road, of which only the former has been attested as yet. Non-destructive research has failed to produce further positive evidence, and the finds assemblage is rural rather than military. On account of its uncertain character the site has not been included in the nomination.
12	Arnhem-Meinerswijk	Auxiliary fort, civil settlement. The fort at Meinerswijk was located at a strategic position near the bifurcation of the Rhine and the Gelderse IJssel. It is assumed that the latter can be partially equated with a canal dug by the Roman army to create a shorter route to the north, but this has not yet been archaeologically confirmed. The canal was used in the German campaigns of 12 BC and AD 15. At Arnhem-Meinerswijk the remains of a succession of forts and the associated extra-mural civil settlement have been discovered, but a considerable part of the site has been eroded by the river. The best known remains are those of the stone headquarters and defences at the rear of the fort. In the eastern part of the Dutch river area it is the only representative of the 'delta type' fort, and the only one so far with surviving remains. The finds assemblage points to activity at this site from c. AD 10/20 until 250, with some Late Roman activity here as well. Structural remains from the early period have not yet been attested since the limited excavations barely reached the earlier layers, but given the high groundwater table the quality of preservation is probably very good. It is also possible that the former river channels which have eroded the fort and the civil settlement still contain Roman remains at great depth. The attested and projected remains, and the fort's association with key historical events, are the reasons for inclusion the site in the nomination.
---	Duiven-Loowaard	Auxiliary fort. Large-scale quarrying of sand and gravel has produced considerable numbers of unequivocally military finds, including massive wall fragments at great depths. These are most likely the remains of a fort which has been largely or entirely eroded by the Rhine. It is so far unknown whether any parts of the military complex have remained intact, so it is impossible to establish its boundaries. As the category of eroded forts is adequately represented by Arnhem-Meinerswijk ► 12 and Herwen-De Bijland ► 19 the site has not been selected.
---	Elst-Westeraam	Sanctuary. A few kilometres to the east of the temple of Elst-Grote Kerk a smaller Gallo-Roman temple has been excavated. This temple belonged to a nearby rural settlement. There are no indications of any association with the army. Because the temple is nearly completely excavated (with nothing preserved) the temple site has not been selected.
13	Elst-Grote Kerk	Sanctuary. The remains of the temple at Elst are buried below the present Grote Kerk, built in the 15 th century, and its Early Medieval predecessors. In its final shape the temple belongs to the so-called Gallo-Roman type, combining Roman elements with some only known to the north of the Alps, and was one of the largest temples of this type in the Gaulish and German provinces. The monumentality of the temple at Elst-Grote Kerk suggests that the Roman army was involved in its construction. The main deity assumed to have been venerated here, Hercules Magusanus, appears to have been especially popular among soldiers and veterans. This military connection and the good preservation of timber and stone remains were reasons for inclusion of this site in the nomination.
---	Nijmegen-Ulpia Noviomagus	Civil town. After the destruction during the Batavian revolt of AD 69/70 of the Early Roman urban settlement in the Valkhof area ► 14 , a new civil administrative centre developed c. 2 km further west. The first part of the name of <i>Ulpia Noviomagus</i> refers to the emperor M. Ulpius Traianus (AD 98–117), who granted market rights and possibly also the formal status of <i>municipium</i> (town with legal status) which is attested for a later period. Several public buildings were erected under Trajan, and the use of military building materials hints at the involvement of the army in their construction. In the late 2 nd century the town was provided with a stone wall. It was abandoned in the course of the 3 rd century. The character and development of the town are similar to those of <i>Colonia Ulpia Traiana</i> at Xanten ► 27 and of <i>Forum Hadriani</i> at Voorburg-Arentsburg ► 3 , where the conditions for sustainable protection are much better. For this reason the civil town of Nijmegen-Ulpia Noviomagus has not been selected.

id	name	brief description
14a	Nijmegen-Valkhof area Valkhofpark	<p>Early Roman town, Late Roman fort.</p> <p>The Valkhof area encompasses two elements of the frontier: an Early Roman town and a Late Roman fort. The town may have been founded as early as 10 BC. It had a ribbon-like layout, and the nucleus of the settlement must have been at least 10 ha in size. The finds assemblage indicates that the first inhabitants may have been or included army veterans. It is assumed that the settlement served as the urban centre for the tribal area of the Batavians. Its military start-up and slow urban development is probably representative of the military zone on the left bank of the Rhine. During the Batavian revolt of AD 69/70 the civil settlement was destroyed.</p> <p>In the late 3rd century AD a fortification was built on the Valkhof plateau, defended by a stone wall and a double ditch system. The enclosed area measured c. 2.8–4 ha. Two additional ditches surrounded the fort at c. 40–90 m to the southwest and west, probably encompassing a vacant zone which may have functioned as an additional defensive slope (glacis). The occupation of the fort seems to have continued at least into the 5th century.</p> <p>It is the only site in the Dutch frontier zone with incontestable physical remains of a Late Roman military fortification. Parts of the northern defensive stone wall may have been included in later, still standing walls. A considerable part of the fort was built over by a Carolingian palace, which probably had an Early Medieval predecessor. The remains of the inner area of the fort are hidden beneath those of the palace. The almost complete lack of excavation explains why we have no information on the state of preservation of the fort's interior or of the remains of the early town underneath it. Component part 14a is an unexcavated zone situated within the inner ditches of the Late Roman fort. It is also located within the core area of the Early Roman town.</p>
14b	Nijmegen-Valkhof area Hunnerpark	<p>For a general description cf. component part 14a.</p> <p>Component part 14b is an unexcavated zone situated partly inside, partly outside the inner ditches of the Late Roman fort on the eastern side of the Valkhof area. It may cover part of the additional defensive slope (glacis) delineated in the west and southwest by two outer ditches. It is also located within the core area of the Early Roman town.</p>
15	Nijmegen-Hunerberg	<p>Operational base, legionary fortress, civil settlement.</p> <p>The Hunerberg holds the remains of a large Augustan military base, and of a legionary fortress of the late 1st and early 2nd centuries with its extra-mural civil settlement and associated cemeteries. The earliest fortification, covering more than 40 ha, served as an operational base c. 19–16/12 BC. It can be viewed as the cradle of the Lower German Limes.</p> <p>After the suppression of the Batavian revolt in AD 70 the area of the Augustan operational base was built over by construction of a regular legionary fortress and its extra-mural civil settlement. The latter extended eastwards as far as the by then abandoned fort on the Kops Plateau ►16. The legionary fortress is closely associated with the aqueduct ►17 and the industrial site of De Holdeurn ►18 at Berg en Dal.</p> <p>Extensive parts of the early operational base remain unexcavated and therefore unknown, but they most likely conceal the remains of the large storage facilities essential to the survival of such a forward base. The later complex of legionary fortress and extra-mural settlement is fairly well preserved as a whole, although there is little information about the burial zones belonging to the settlements.</p> <p>About two-thirds of the area occupied by this complex remain unexcavated and some of the earlier excavations (before 1970) did not involve complete destruction. This allows the Hunerberg site, with its succession of different military installations and associated features, to be included in the nomination.</p>
- - -	Ubbergen-Rijksstraatweg	<p>Military harbour (?).</p> <p>In the Roman period the river Waal had a meander at the foot of the ice-pushed moraine. It might be expected that a harbour serving the legionary fortress of Nijmegen-Hunerberg ►15 would have been located here, but efforts to locate it have so far failed.</p>
16a	Nijmegen-Kops Plateau West	<p>Fort, cemetery, waste deposit, civil settlement.</p> <p>The Kops Plateau, a small elevated plateau along the edge of the ice-pushed moraine of Nijmegen-Kleve, contains the remains of an irregularly shaped Early Roman fortification with several annexes (extra-mural military compounds) and cemeteries. The military settlement was established c. 12 BC and evacuated during the Batavian revolt of AD 69/70.</p> <p>An oversized residential building (not preserved) indicates that the fort was atypical; functions that have been proposed include a command post during the German wars of the emperor Augustus and a training facility for the highly valued Batavian cavalry. Although three quarters of the military installation has been excavated (with nothing preserved of uncovered features), the fort and associated features have been included in the nomination. They constitute an unparalleled complex with elements including the irregular shape of the fort, an overrepresentation of residential buildings, extra-mural military structures, a remarkably luxurious finds assemblage and the presence on the northern slope of the plateau of a rubbish deposit which provides a layered history of the material culture of the garrison. The surviving remains are remarkably intact, although timber and other organic remains have usually decayed.</p> <p>After the abandonment of the fort during the Batavian revolt of AD 69/70, the plateau continued in use. The road leaving the eastern gate of the legionary fortress on the Hunerberg ►15 crossed the plateau from west to east, just south of the fort. Graves have been attested at several points along this road and the cemeteries belonging to the earlier fort remained in use. The civil settlement of the legionary fortress (canabae legionis) extended over the western periphery of the earlier fort and its western annex.</p> <p>Component part 16a includes a significant unexcavated part of the Early Roman fort, including a substantial part of the defences, most of the headquarters building and traces of a military annex outside the defensive structures of the main fort. Additionally it preserves features of the civil settlement belonging to the legionary fortress of Nijmegen-Hunerberg ►15 and burial areas.</p>

id	name	brief description
16b	Nijmegen-Kops Plateau North	For a general description cf. component part 16a. Component part 16b is situated on the slope of the ice-pushed moraine. It holds an exceptional rubbish deposit and part of the defensive structures on the northern side of the Early Roman fortification.
16c	Nijmegen-Kops Plateau East	For a general description cf. component part 16a. Component part 16c includes a smaller unexcavated area on the south-eastern side of the Early Roman fortification. It includes a section of the fort defences and several burials belonging to the later legionary fortress of Nijmegen-Hunerberg ►15 and its civil settlement.
16d	Nijmegen-Kops Plateau Kopse Hof North	For a general description cf. component part 16a. Component part 16d encompasses the northern part of an unexcavated area of a cemetery primarily associated with the Early Roman military settlement on the Kops Plateau. The earliest graves date from the early 1 st century AD. The cemetery continued to be used in the 2 nd century AD, probably by occupants of the military settlement on the Hunerberg ►15 and its civil settlement.
16e	Nijmegen-Kops Plateau Kopse Hof South	For a general description cf. component part 16a. Component part 16e encompasses the southern part of an unexcavated area of a cemetery primarily associated with the Early Roman military settlement on the Kops Plateau. The earliest graves date from the early 1 st century AD. The cemetery continued to be used in the 2 nd century AD, probably by occupants of the military settlement on the Hunerberg ►15 and its civil settlement.
17a	Berg en Dal-aqueduct Mariënboom	Aqueduct. Component parts 17a–e include the dams and artificial valleys which were part of an aqueduct system supplying the legionary fortress of Nijmegen-Hunerberg ►15 with fresh water. The aqueduct ran over c. 5.5 km, but only the earthworks have been preserved. Although they have suffered from some erosion over the centuries they are still largely intact. The water channel would most likely have been made of wood, which has not survived in the sandy subsoil of the ice-pushed moraine. The water supply must have been established in the late 1 st century AD and is likely to have functioned until the abandonment of the legionary fortress around the mid-2 nd century. Most known aqueducts supplied water to towns, but several legionary fortresses are also known or are projected to have been serviced by aqueducts. Preserved remains of military aqueducts are rare, however. Projected aqueducts servicing the legionary fortresses of Bonn ►41 and the eroded successor of Xanten-Fürstenberg ►28 have not been properly attested. The remains of the Berg en Dal aqueduct consist of three artificial valleys and two dams. Component part 17a is a shallow artificial valley over 300 m long and 1–2 m deep, excavated to allow water to cross a low hill. The channel and narrow mounds of spoil on either side are still visible today.
17b	Berg en Dal-aqueduct Swartendijk	For a general description cf. component part 17a. Component part 17b is an embankment up to 3.7 m high in its current state, originally probably somewhat higher. The dam was constructed over a distance of c. 250 m to carry the water channel of the aqueduct across a shallow dry valley, similar to component part 17c.
17c	Berg en Dal-aqueduct Cortendijk	For a general description cf. component part 17a. Component part 17c is an embankment up to 4.5 m high in its current state, originally probably somewhat higher. The dam was constructed over a distance of c. 50 m to carry the water channel of the aqueduct across a shallow dry valley, similar to component part 17b.
17d	Berg en Dal-aqueduct Louisedal	For a general description cf. component part 17a. Component part 17d is an artificial valley up to 50–60 m wide and 14 m deep, extending over c. 470 m. Today, the mounds of spoil are up to 4 m high. The valley is assumed to have cut through aquiferous strata.
17e	Berg en Dal-aqueduct Kerstendal	For a general description cf. component part 17a. Component part 17e has two branches. The northern branch is a valley c. 1 km long and up to 35 m wide and 11 m deep. The valley is partly natural and partly artificial, and is assumed to have provided access to springs and aquiferous strata. The southern branch is a small, apparently artificial, lake c. 350 m long and up to 25 m wide, but it is likely to have been larger in the past. It is thought to have been a reservoir for water from the northern branch, with a dam at its western end.
18a	Berg en Dal-De Holdeurn North	Military tile and pottery kilns. Component parts 18a–b encompass the known and projected remains of an industrial site which produced bricks, tiles and pottery from the late 1 st century onwards. Initially the kiln site exclusively supplied the legionary fortress of Nijmegen-Hunerberg ►15, at 4 km to the northwest. In the later 2 nd and 3 rd centuries, however, the site served as the central brickworks for the whole of the army in Lower Germany. Limited excavations c. 1940 demonstrated the presence of kilns, buildings, loam pits and production debris. Most kilns appear to have been dismantled during the excavations, but two kilns were left partly intact, alongside parts of buildings. Geophysical research points to the presence of more kilns and buildings outside the excavated areas, and a coring survey has demonstrated the occurrence of production debris. De Holdeurn has been selected to illustrate this important aspect of military production and supply. The two other known military production sites for tiles and pottery (Dormagen, Xanten) are mostly excavated or otherwise destroyed, and De Holdeurn is the only one which serviced the whole of the army in Lower Germany. Component part 18a encompasses loam pits and areas with production debris.

id	name	brief description
18b	Berg en Dal-De Holdeurn South	For a general description cf. component part 18a. Component part 18b includes most of the remains of the kiln site, with unexcavated parts of buildings and two kilns, loam pits and dumps of production debris. There is every reason to expect further kilns and buildings here.
19	Herwen-De Bijland	Auxiliary fort, temporary camp. From the 1920s onwards, eroded remains of a stone fort have been found at great depths during sand extraction, and there are still some remains in the resulting quarry pool known as De Bijland. Most of the dredged finds are dated c. AD 70–260, but there is an earlier inscription making explicit reference to a groyne or dam. This groyne is one of the most famous examples of Roman water management, a barrier built in the river c. 12–9 BC to increase the water volume of the northern branch of the Rhine in the delta. Such a vital regulating element of water management must have been guarded by a fort. It has long been thought that the entire military settlement had been eroded by post-Roman migration of the river bends, but recently the ditches of at least two military installations have been found c. 250 m northeast of the location of the dredged finds. One of the ditches has a very clean fill, which is typical of short-lived, temporary camps. The pottery assemblage and metal objects from the excavated area confirm the military character of the features. Although the remains at De Bijland are very incomplete examples of military installations, the extraordinary narrative connected to them justify their inclusion in the nomination.
20	Kleve-Keeken	Fort or semi-permanent camp. The camp is situated on a slight elevation on a floodplain terrace, directly west of an old course of the river Rhine and next to the bifurcation of the Rhine and the Waal. It was positioned opposite the fort of Herwen-De Bijland ▶19 and its function may have been to control and protect river transport at this strategic point. The camp was first discovered in 2016 by aerial photography. It has two parallel ditches some 1.5 m in width indicating a longer occupation period than overnight marching camps which usually have only one ditch. The western side is some 240 m in length. The eastern side has not yet been detected. It measures at least 150 m so the camp encompasses an area of at least 3.6 ha. It is thought that the camp could have occupied an area up to 8.5 ha in size. No internal structures are known as yet. No information on the chronology of the camp is currently available.
21a	Kleve-Reichswald West	Limes road. Two component parts represent a well-preserved section of the Limes road between Till ▶22 and Nijmegen ▶14–16. The road runs in an east-west direction along the ice-pushed moraine at Kleve. Traces of a 7 m-wide road embankment have been recorded by LiDAR. The embankment still has a height of c. 0.5 m. Two stretches are recorded, measuring 410 m (western part) and 175 m (eastern part). A stretch of 570 m in between has not been preserved above ground. Recent excavations revealed that the road had a width of approx. 12–15 m including the road ditches. The embankment is formed of several layers of compacted gravel. The date of the Limes road in this section is not yet known. It may have served as the major military road from the beginning of the Roman occupation in the second decade BC until the end of the Lower German Limes in the 5 th century.
21b	Kleve-Reichswald East	Limes road. For a general description cf. component part 21a. This component part contains the stretch of 175 m of the Limes road.
---	Kleve-Rindern	Auxiliary fort (?). Roman finds and the discovery of a heated room with hypocausts in the area of the church and cemetery in 1870/72 indicated Roman activity in the area of the modern village of Rindern. Its medieval name 'Renharen' has been suggested as being the medieval form of a Roman place called <i>Harenatium</i> or <i>Arenatium</i> , mentioned in Roman written sources of the 1 st and 3 rd centuries as a military site between Xanten and Nimwegen. As yet, no archaeological evidence for a military installation has been recorded.
---	Bedburg-Hau-Qualburg	Late Roman fort (?). Two profiles of one or two Late Roman ditches located north and east of the church of Qualburg and its cemetery were recorded in small scale excavations in the 1930s. Taken together with a further record of a Late Roman ditch south of the church in 1990, a Late Roman fortification in that area is very likely. It has been suggested this might be the Late Roman site of <i>Quadriburgium</i> (Latin for 'Four-tower-fortification') mentioned in written sources for the 4 th century. However, there is no evidence for Late Roman walls, towers or gates, leaving the actual size and form of the presumed fortification unclear. The modern cemetery that covers much of the site makes further investigation difficult.
22	Till	Legionary fortress, auxiliary fort, five temporary camps, civil settlement. The nominated property of Till includes a range of eight military installations of different size and function. The installations range from temporary camps to a permanently occupied auxiliary fort. The whole area is fairly level and slightly raised above the flood plain. The area is defined by a small, early Holocene course of the Rhine to the west and by a larger pre-Roman course of the Rhine to the east, silted up in the Bronze age (Tiller Graben). The Roman course of the river Rhine, which probably ran several hundred metres further east, has been eroded by later courses of the river in the Middle Ages. The earliest dated military installation is a camp at the Steincheshof measuring 184 × 180 m. A V-shaped ditch dating to the 1 st century is the only known feature. Interior structures are not recorded. Its function as a temporary (marching?) camp or early permanent fort is unclear. It was succeeded by an auxiliary fort with an area of 2 ha (162 × 140 m), constructed in the centre of its

id	name	brief description
		<p>predecessor. The fort was probably built early in the 70s AD. Excavations have revealed several building phases. It continued in use at least into the 180s AD.</p> <p>About 300 m NW, around the neighbouring Kapitelschhof, five military installations of different size and function are recorded. The exact sequence has not so far been determined.</p> <p>Through a combination of aerial photographic and geophysical data, it has been possible to determine that fortress B measured about 515 × 382 m (19.2 ha). It was fortified with up to five ditches and an earth-and-timber rampart which has been recorded in part. It is unclear whether the troops lived under canvas or whether interior buildings were constructed.</p> <p>Fortress B was followed by camp A, which is defined by two or three ditches. It measures about 314 m from SE to NW and at least 414 m transversely. It encloses a minimum of 13.1 ha and overlaps the northern part of fortress B. Both installations were probably abandoned after several weeks or months of use in the second half of the 1st century AD. Aerial photographs show parts of defensive ditches of at least three further temporary camps of unknown size and dating. They may all have served as marching camps.</p> <p>Further to the NW lies a very large marching camp next to the Sandkampshof. The southwest side of the camp measures 552 m, and over 380 m of the southeast side has been recorded. The camp, therefore, occupies an area of at least 25 ha but may have been larger. A series of pits is visible inside the camp in two locations; close to the perimeter and in the centre.</p>
23	Kalkar-Kalkarberg	<p>Sanctuary.</p> <p>The sanctuary lies on the edge of an ice-pushed moraine with a wide field of visibility into the valley of the meandering Rhine to the east. The main road between <i>Burginatum</i> via Kleve-Reichswald to Nijmegen ran on this moraine and passed the sanctuary on its western side.</p> <p>The sanctuary was enclosed by a <i>temenos</i> wall enclosing an area of 1.6 ha (150 × 110 m). In the centre of the sanctuary is a Gallo-Roman temple measuring 15 × 15 m. It is clearly smaller, but similar in construction to the temple at Elst ▶13, with a cella and a surrounding colonnade. Next to it there is another rectangular cult building of 14 × 8 m. At the back of the complex there is a residential building, which probably accommodated priests or pilgrims. Dedicatory inscriptions have been found, left by soldiers from Kalkar-Bornsches Feld ▶24 and legionaries from Xanten-Fürstenberg ▶28. The Roman sanctuary existed from the 1st to the 4th centuries. Below the temple a pre-Roman cult site was detected. It consisted of at least two ditches forming an irregular oval of around 65 × 70 m.</p>
---	Kalkar-Monreberg	<p>Pre-Roman enclosure.</p> <p>A 15 ha polygonal enclosure formed by three parallel ditches located in the immediate vicinity of the auxiliary fort of Kalkar-Burginatum has previously been interpreted as a Roman vexillation fortress. Recent geophysical surveys have led to a re-interpretation of the site as a pre-Roman fortified settlement.</p>
24	Kalkar-Bornsches Feld	<p>Auxiliary Fort, civil settlement, cemetery, limes road, fort (fleet base?), temporary camp or fort, waste deposit.</p> <p>The nominated property of <i>Burginatum</i> includes several military and civil installations which extend over an area of at least 1,000 × 600 m. Most of them are known from geophysical surveys. The elements are situated on a flood-free area directly on the Roman course of the Rhine at the bottom of the ice-pushed moraine.</p> <p>A smaller fort detected by geophysical survey, with a defensive ditch and a central building (<i>principia</i>?), was probably its predecessor. It was at least 100 m × min. 30 m in size. The front side facing the Rhine is unknown and it may be that the fort was open to the river bank as is the case for early fleet bases elsewhere.</p> <p>The cavalry fort of <i>Burginatum</i> is situated in the centre of this intensively used site. The fort measured 205 × 190 m (3 ha) in the main building phase, including the defensive ditches. In the Late Roman period, the fort was reduced in size to about 2 ha and the main wall strengthened by an outer second wall. At 2 ha this was still a large base compared to other Late Roman forts along the Lower German Limes. Erosion seems to have caused the loss of the north-eastern corner over an area of approx. 800 m² whilst the fort was in use. A new massive wall closed the gap, following the newly formed bank of the river Rhine.</p> <p>Remains of another camp can be found further east, largely washed away by the Roman Rhine. The vicus with several buildings (strip houses) and cellars extends about 500 m along a road running southwest of the fort. A <i>mansio</i> (Roman hostel) measuring 65 × 37 m is located in the centre of the vicus at a main crossroads. The road turning off to the southeast runs in an arc around the fort. The road embankment can still be seen on the surface. Several graves have been found to the west and south of the vicus, indicating larger cemeteries.</p>
25a	Uedem-Hochwald Hochwald 1	<p>Temporary camp.</p> <p>The camps are located in what is now a wooded area, on the northern edge of the ice-pushed moraine and on meltwater sands. The complete cluster comprises 13 camps ranging in size from 0.5 to 2.5 ha.</p> <p>Oriented partly in rows or in the same orientation, they relate to each other. There is no overlap. The defences of the camps consist of an earthen rampart, which is typical for Roman marching camps. These ramparts were constructed with turves (lat. <i>caespites</i>), laid to form a wall. The gates are without exception in the form of <i>claviculae</i> (literally keys) his special method of fortification can be identified clearly in the field today.</p>
25b	Uedem-Hochwald Hochwald 2	<p>Temporary camp.</p> <p>For a general description cf. component part 25a.</p>
25c	Uedem-Hochwald Hochwald 3	<p>Temporary camp.</p> <p>For a general description cf. component part 25a.</p>

id	name	brief description
25d	Uedem-Hochwald Hochwald 4	Temporary camp. For a general description cf. component part 25a.
25e	Uedem-Hochwald Hochwald 5	Temporary camp. For a general description cf. component part 25a.
25f	Uedem-Hochwald Hochwald 6	Temporary camp. For a general description cf. component part 25a.
25g	Uedem-Hochwald Hochwald 7.1	Temporary camp. For a general description cf. component part 25a.
25h	Uedem-Hochwald Hochwald 7.2	Temporary camp. For a general description cf. component part 25a.
25i	Uedem-Hochwald Hochwald 8.1	Temporary camp. For a general description cf. component part 25a.
25j	Uedem-Hochwald Hochwald 8.2	Temporary camp. For a general description cf. component part 25a.
25k	Uedem-Hochwald Hochwald 9	Temporary camp. For a general description cf. component part 25a.
25l	Uedem-Hochwald Hochwald 10	Temporary camp. For a general description cf. component part 25a.
25m	Uedem-Hochwald Hochwald 11	Temporary camp. For a general description cf. component part 25a.
25n	Uedem-Hochwald Hochwald 12	Temporary camp. For a general description cf. component part 25a.
25o	Uedem-Hochwald Hochwald 13	Temporary camp. For a general description cf. component part 25a.
- - -	Xanten-Vynen	Auxiliary fort (?). Finds from gravel extraction in the 1980s indicate Roman activity in this area. One brick stamp of an auxiliary unit (<i>cohors II Britonum</i>) may indicate military building activity. The area has been dug out by gravel extraction. No indication of any in-situ preservation.
26a	Wesel-Flüren Flürener Feld 1	Temporary camp. The camps are located on the right banks of the river Rhine and north of the mouth of the Lippe valley, in a raised position on the lower terrace. Four camps with a size of 1.2 to 2.4 ha preserved above-ground form part of a cluster along with further camps known from aerial reconnaissance. The defences of the camps consist of an earthen rampart, which is typical for Roman marching camps. These ramparts were constructed with turves (lat. <i>caespites</i>) laid to form a wall. The gates are without exception in the form of <i>claviculae</i> (literally keys).
26b	Wesel-Flüren Flürener Feld 2	Temporary camp. For a general description cf. component part 26a.
26c	Wesel-Flüren Flürener Feld 3	Temporary camp. For a general description cf. component part 26a.
26d	Wesel-Flüren Flürener Feld 4	Temporary camp. For a general description cf. component part 26a.
- - -	Xanten-Lüttingen	Watchtower A Roman timber watchtower with a succeeding stone construction phase has been recorded by rescue excavation. The site has been entirely destroyed by gravel extraction. The stone built phase of the watchtower has been marked on a new location ex situ.
- - -	Xanten-Vynen/Lüttingen	Battlefield (?). Finds of military equipment and of a stone inscription made in the 1980s during gravel extraction in the channel of a Roman branch of the Rhine. A possible link with a battlefield of the Batavian Revolt in AD 69–70 has been suggested. So far there is no evidence for in-situ preservation in this area.
- - -	Xanten-CUT	Auxiliary fort(s) (?). A 2003 study of finds of military equipment from the area of the later CUT has led to the suggestion that Roman military installations existed at this site in the 1 st century before the <i>colonia</i> was founded in AD 100. Recent re-consideration has thrown doubt on these suggestions and no clear evidence for 1 st century Roman fortifications in the area of the later <i>colonia</i> can be attested so far.
27	Xanten-CUT	Limes road, city, fort, Late Roman fort, harbour. The component part lies in a slightly elevated position on the lower terrace, directly above the Roman Rhine. Several military installations were located on the 70 ha area of the <i>Colonia Ulpia Traiana</i> (CUT). The Limes road runs from northwest to southeast through CUT. Its course is slightly different to the orientation of the later division of the Roman city into <i>insulae</i> and therefore older. The road had a width of 18.5 m and consisted of a gravel base with a hard, concrete-like surface. There are accompanying ditches on both sides. In the surface of the road there are clear grooves approx. 1.4 m apart, created by carts and wagons. It is clear therefore that the ancient road surface is preserved.

id	name	brief description
		<p>In the south of CUT is an area of 3.9 ha fortified with a wall in the second half of the 3rd century. At its south-western and south-eastern end points, this wall connects directly to the CUT city wall, using it as the southern boundary. There were simple gates with gate towers in the north-west and northeast sides of the enclosure. The military use of the fortified area is obvious. One possible interpretation is that it was erected as a temporary military camp in the context of the Franconian raids of the last third of the 3rd century and the planning and construction of the <i>Tricensima</i> within the former city area of CUT.</p> <p>The <i>Tricensima</i> was created by transformation of the central nine insulae of CUT into a fortification in Late Antiquity. The defence of the <i>Tricensima</i> consisted of a 3.5 m wide wall with 11 intermediate towers, four corner towers and gates. Around 8.5 m in front of the wall, the fortress was protected by two surrounding ditches, each 12 m wide. It probably played a fundamental role in the organisation of Late Roman border security. In addition to stationing military units, it probably also offered shelter to civilians from the former Colonia.</p> <p>In front of the city walls, the harbour quay extended over a maximum length of 230 m along the banks of the Rhine, mainly in front of the later Insula 36. The harbour was probably built around the middle of the 1st century AD and so served as a supply station for the legionary fortresses for at least half a century before the foundation of CUT. The bank was reinforced to protect it from erosion. There is evidence of a boathouse southeast of the dock.</p>
---	Xanten-Halenboom	<p>Military tile and pottery kilns.</p> <p>The tile and pottery kilns, operated by several different military units according to associated brick stamps, have been entirely excavated and built over in the 1930s and 1960s. No significant remains have been left in situ.</p>
28	Xanten-Fürstenberg	<p>(Double-)Legionary fortresses, civil settlement, Limes road.</p> <p>The component part, which includes the double-legionary fortresses, civil settlement, an amphitheatre and several very large military building units, is located on an ice-pushed moraine clearly elevated above an old arm of the Rhine. The total area of the complex measures about 1,600 × 900 m. The highest point today is 71.6 m above sea level. The amphitheatre is located in a depression 30 m above sea level.</p> <p>The double-legionary fortresses each covered a similar area of about 57 ha. However, their form and orientation differ. The early fortress is polygonal in shape with internal rectangular divisions. It dates to the Augusto-Tiberian period and was of earth-and-timber construction. The dimensions measure about 750 × 800 m. The succeeding Claudio-Neronian fortress measures approx. 600 × 900 m and has the typical rectangular playing card shape. The interior buildings are of stone while the rampart comprises earth-and-timber. Its location half on a slope and half on level ground as described by Tacitus can still be seen today. The almost complete ground plans of both legionary fortresses are known from large-scale geophysical survey.</p> <p>In addition to the two double-legionary fortresses, there are at least two large parade grounds within the property, (so-called <i>campi</i>, which offered the legionaries space for training and marching) as well as the amphitheatre. In the north, there are also structures that may represent civilian settlement structures in the immediate vicinity of the legionary fortresses (lat. <i>canabae legionis</i>). Roads have been found leading in every direction, demonstrating the importance of Lower Germany's largest legionary fortress as a key junction for traffic in this region.</p>
---	Xanten-Vetera II	<p>Legionary fortress (eroded).</p> <p>Roman finds made in the 1950s during gravel extraction at the 'Bislicher Insel', an area of multiple medieval branches of the Rhine, have been interpreted as the site of the legionary fortress of Vetera II, the late 1st century successor of Vetera I at the Fürstenberg. A recent study of epigraphic records found in the 17th and 18th centuries in that area has suggested that the fortress may have been located several hundred metres to the north. The whole area has been eroded by shifting courses of the Rhine from the 16th to the 18th centuries and nothing has been preserved in situ.</p>
---	Wesel-Büderich	<p>Auxiliary fort (?).</p> <p>Finds of military equipment made in the 1930s near Wesel-Büderich have been interpreted as a military site. Geophysical surveys and an extensive aerial survey programme have not revealed any significant structures.</p>
29	Alpen-Drüpt	<p>Auxiliary fort, large temporary camps.</p> <p>The cluster is located on the younger lower terrace, above an oxbow of the Rhine that silted up in Late Roman or medieval times. The site is surrounded by pre-Roman river courses still marshy today, making the location a very narrow strip between the riverine landscape and dry land.</p> <p>In the southern part of the property lies an auxiliary fort, the eastern part of which has been eroded by the Rhine. An area of 1.5 ha of the fort has been preserved. The central part of the interior layout of the fort is very well documented through non-invasive methods. The headquarters (lat. <i>principia</i>), the commander's house (lat. <i>praetorium</i>) and a storage building (lat. <i>horreum</i>) are recorded by aerial photographs and magnetometer survey.</p> <p>Outside the fort there is another large building which probably served as a storage depot.</p> <p>North of the fort lie two large marching camps whose ditches can be traced over several hundred metres. Rounded corners evidence the typical Roman army design. The eastern side of camp 2 has been eroded by the Late Roman or early medieval Rhine. It is preserved to a size of at least 517 × 400 m (c. 20 ha) making it the second largest marching camp along the Lower German Limes besides fortress B at Tüll ▶ 22.</p> <p>Camp 3 partly overlaps camp 2, and is rotated about 45 degrees. This slightly smaller camp of at least 15 ha has dimensions of 369 × at least 380 m.</p>

id	name	brief description
---	Area of Alpen, Xanten, Wesel, Kalkar	Temporary camps. In the area of Alpen, Xanten, Wesel and Kalkar, almost 200 temporary camps have been recorded by aerial photography since the 1960s indicating that only parts of the ditches are preserved and that earthen ramparts have been destroyed by ploughing in medieval and modern times. Only temporary camps with significant preservation of earthen ramparts (as detected by LiDAR in forest areas), have been selected for the nomination as the most complete and representative examples of Roman marching camps ► 25–26.
---	<i>Calo</i>	Cavalry fort (?). Roman finds from gravel extraction in the 1950s from Duisburg-Beeckerwerth have been interpreted as the site of a cavalry fort called <i>Calo</i> mentioned in Roman written sources of the 4 th century. The name of a medieval settlement called Halo, eroded by the Rhine in late medieval times, may indicate that the fort or its memory still existed at that time. The site seems to have been totally eroded by later changes in the course of the river Rhine.
---	Rheinberg	Military road station (?). Excavations in the 1960s revealed a Roman timber building in the centre of an almost rectangular enclosure with a V-shaped ditch next to the presumed course of the Limes road between Moers-Asberg and Xanten. Because the structure differs in many ways from typical Roman watchtowers and there are no small finds that might indicate the presence of Roman military, the former interpretation as a military site is not proven.
30	Moers-Asberg	Auxiliary fort, Late Roman <i>burgus</i> . The fort is situated on the flood-free left bank of the Rhine, at the later Essenerberger Altarm, which silted up in Late Antiquity, on a site that still dominates the modern topography of this area. The first fort was built around 16/15 BC in polygonal form and was surrounded by an earth-and-timber rampart and two ditches. There is no evidence for interior buildings; the soldiers seem to have lived under canvas. After AD 17 a new fort was built in a similar manner, with several subsequent re-building phases. The fourth phase is marked by the foundation, around AD 45, of a regular auxiliary fort for a cavalry unit of about 500 men (lat. <i>ala</i>). This had interior buildings, of which the headquarters and barracks are attested. After the Batavian revolt, the fort was totally rebuilt in an almost rectangular form of c. 170 × 190 m (3.2 ha), still serving a cavalry unit. In Late Antiquity, a small fortification with a central tower and a wide ditch (<i>burgus</i>) was erected in the south-eastern area of the long abandoned auxiliary fort.
---	Moers-Asberg	Marching camp (?). Profiles of one or more V-shaped ditches south of the auxiliary fort of <i>Asciburgium</i> have been interpreted as being part of a marching camp of the Roman governor C. Didius Voluta during the Batavian revolt in AD 69. The suggested oval form of the camp is without any parallel amongst Roman marching camps. No dateable finds support this interpretation. The original function of the ditches is therefore unclear.
31	Duisburg-Werthausen	Fortlet. The fortlet was located on the former right bank of the Rhine, near the auxiliary fort of <i>Asciburgium</i> . It measured about 46 × 41 m. The wall had two gates, in the east and in the west, and four corner towers. The walls, made of tuff set in mortar, lie almost directly under the topsoil. In the west-east running road a cistern has been preserved which was mistakenly interpreted as a burial place during excavations at the end of the 19 th century. The fortlet was probably built after AD 85, when the auxiliary fort <i>Asciburgium</i> was abandoned. It existed until the middle of the 3 rd century.
32	Krefeld-Gellep	Auxiliary fort, battlefield, civil settlement and cemetery. The fort lay on the flood-free terrace next to the Rhine. The Roman course of the Rhine is similar to the modern harbour basin, but the modern Rhine is about 600 m away. <i>Gelduba</i> is also a battlefield site associated with the Batavian revolt. Parts of the battlefield with unique archaeological features are located under the fort or in the immediate vicinity. They tell the story of the attack by the Batavians on the camp of the Governor Caius Dillius Voluta. The auxiliary fort was founded as a base for a cavalry unit (lat. <i>ala</i>) after the Batavian revolt in AD 70 and redesigned over various phases. At first it was of timber construction. Further timber construction phases were replaced by a stone construction of about 140 × 170 m (2.38 ha) in the middle of the 2 nd century. In the second half of the 3 rd century the fort was rebuilt following Germanic invasions. In the 4 th and early 5 th centuries, the fort comprised a new, smaller construction (2.25 ha) with strong defensive elements. Traces of the battlefield are both attested and projected south of the fort.
---	Neuss-Innenstadt	Late Roman fortress (?). Late Roman written sources dated AD 388 mention a Roman fort named <i>Nivisium</i> . Its location has been supposed to lie in the modern inner city of Neuss where some indications of Late Roman activity have been recorded. To date no Late Roman fortification structures have been attested in this area.
---	Neuss-Hummelbachaue	Late Roman fortification (?). Results of a rescue excavation in the area of a golf course led to the doubtful identification of a small Late Roman timber fortification.

id	name	brief description
33	Neuss-Koenenlager	<p>Legionary fortress, auxiliary fort.</p> <p>The legionary fortress is located on a flood-free terrace. East of the fortress the river Erft flowed into the Rhine which, in antiquity, ran directly north of the legionary fortress. In Roman times, the Rhine ran quite straight from southeast to northwest for a distance of 6 km between Neuss and the Reckberg, creating a strategically suitable location.</p> <p>The fortress was built in AD 43 by the <i>legio XVI Gallica</i>. It measures 570 × 420 m, so with an area of 24 ha it is a relatively large fortress, with space for auxiliary troops as well as legionaries. The Kölner Straße (<i>via principalis</i>) provides a cross-section through the layout of the legionary fortress, including the southern facades of the central staff building (<i>principia</i>), the bath (<i>balineum</i>) as well as the barracks of the 1st cohort and additional troops. North of it are the barracks for a cavalry unit (lat. <i>ala</i>), which was integrated into the legionary fortress. The fortress was destroyed during the Batavian revolt the fortress was destroyed and then rebuilt by the <i>legio VI</i>. It was abandoned around AD 100.</p> <p>From the middle of the 2nd century to the 4th century there was an auxiliary fort in the central area of the former legionary fortress with a size of about 3 ha. It encloses the area of the former <i>principia</i> and maintains the same orientation. The equestrian unit <i>ala Afrorum</i> was stationed here. A gravestone from its <i>signifer</i> has been preserved.</p>
34a	Neuss-Reckberg Wachturm	<p>Watchtower.</p> <p>200 m northwest of the fort, Constantin Koenen uncovered the foundations, made of Liedberger sandstone, of a watchtower. They measure 5 × 5 m. It is not known whether the tower was surrounded by a palisade and a ditch like those along the Upper German-Raetian Limes or with two ditches like the watchtower at Utrecht-Groot Zandveld ▶ 9.</p>
34b	Neuss-Reckberg Kleinkastell	<p>Fortlet.</p> <p>The fortlet measures 34.5 × 33 m. It was first built as an earth-and-timber construction and later expanded in stone with a 3 m wide gate integrated into the 2.2 m wide stone wall. The small fort is protected by a double V-shaped ditch.</p>
35	Monheim-Haus Bürgel	<p>Late Roman fort.</p> <p>The Late Roman fort was relocated to the right bank of the Rhine as a result of a shift in the course of the river in the 14th century. In Roman times the course of the river formed a loop that extended far into the area now on the right bank of the Rhine.</p> <p>Large parts of the Late Roman fort are still preserved up to 4 m high in the medieval castle complex and the early modern country estate.</p> <p>The 64 × 64 m fort was built in the Constantinian period. It was constructed using massive cast brickwork, divided by horizontal brick lines. The brickwork visible today is the inner part of what was originally a 2.4 m thick wall, with four projecting corner towers and eight interval towers. Torsion weapons could be operated from platforms on the corner towers. Gates, with a passage width of 3.6 m, were located in the east and west walls.</p> <p>The interior buildings of the fort were built directly onto the fortified wall. They were built partly in stone and partly in timber. A bathhouse was located in the south-eastern corner, extending at least 8 m into the inner courtyard. The remaining area was probably open.</p>
36	Dormagen	<p>Auxiliary fort.</p> <p>The fort is situated on a flood-free terrace. In Roman times it was located directly by the Rhine; today the river runs about 1 km east from the fort.</p> <p>The fort was built of wood in the 80s of the 1st century AD and re-built in stone around AD 150. It covers an area of 3.3 ha. Numerous excavations make it easy to reconstruct the interior structure of the fort. Around the centrally located headquarters building (lat. <i>principia</i>) in the rear area, there are long barracks in which soldiers and horses were accommodated together in adjacent rooms. It has been calculated that there were 500 soldiers and horses inside the fort. In the front part of the fort there is a workshop, a storage building and the commander's quarters as well as more barracks. Following the burning of the fort in AD 161, the north corner continued in sporadic use until the end of the 3rd/beginning of the 4th century, when a reduced fort was built in this area, using the former fort wall. It was in use until AD 430. Several roads still follow the orientation of the Roman fort today.</p>
- - -	Dormagen-Bayerwerk	<p>Tile kiln.</p> <p>Four Roman tile kilns associated with brick stamps of the 1st legion were excavated in the 1960s during construction of a public bath. No significant remains have been preserved.</p>
37	Köln-Praetorium	<p>Governor's palace.</p> <p>The palace was situated in a prominent, elevated position on the eastern edge of the city plateau, overlooking the city wall and the river. The whole complex occupied two blocks (lat. <i>insulae</i>); an area of about 150 (N–S) × 60 m has been extensively excavated. The remains of four main building phases were found, one overlying the other, resulting in a warren of walls not easy to distinguish; many of the main phases showed secondary alterations whilst in use. A key observation was that the main (eastern) front of the complex was moved progressively closer to the city wall. The first phase dates to the very beginning of the 1st century. In the late 1st century, massive north-south walls and a first version of an <i>aula</i> were constructed in the southern part of the complex. In this phase the main building was characterised by an eastern façade with two big apses. Around the mid-180s, the whole complex of 90 × 25 m was rebuilt under the governor Didius Iulianus, later Emperor of the imperium for a short period. A new, bigger <i>aula</i> with an apse at the eastern end was included in the complex. The last palace (constructed after the middle of the 4th century) was characterised by a 90 m long façade with porches or pavilions at both ends and a central, octagonal, tower over 20 m high and more than 15 m in diameter. The interior was characterised by large, hall-like rooms, whereas the adjoining part to the west comprised smaller rooms arranged around an open courtyard.</p>

id	name	brief description
		The abandonment of the palace continues to be discussed by scholars; some think it was never completely finished, others think there is evidence that it was still in use, at least partly, during the Frankish period and that it was finally destroyed in the second half of the 8 th century.
38	Köln-Deutz	<p>Late Roman fort.</p> <p>The bridgehead fort of Deutz played an important part in Emperor Constantine the Great's building programme to reinforce the defensive line along the river frontier. It was located east of the Rhine, directly on the bank of the river. It was connected with the <i>Colonia Claudia Ara Agrippinensium</i> by a bridge over 400 m long. The fort was surrounded by a ditch on three sides (12 m wide, 3 m deep) and formed a square with sides of 148 × 148 m (more than 2 ha). The curtain wall was 3.3 m thick, a minimum of 8 m high and had 14 round towers that protruded much more on the exterior than the interior faces. There were two double-towered gates to the west and east, the fort being divided in two halves by the <i>via praetoria</i> connecting them. The interior was completely taken up by 16 rectangular, north-south oriented barracks (58 × 11.5 m), constructed with stone foundations carrying timber-framed walls. The four middle barracks had porticoes on their narrow sides opening onto the centre of the fort; in one of them, close to the southern defences, a bathhouse was located. Around the barracks were gravelled roads with wooden sewers beneath. In the current state of research, <i>Divitia</i> is one of the few examples of a Late Roman fort where the interior layout is fully understood.</p> <p>According to epigraphic evidence and written sources, the fort was built between 309/10 and; the garrison consisted of about 800–1,000 soldiers. Based on the finds, the fort continued to be used by Frankish <i>foederati</i> under Roman command until the middle of the 5th century.</p>
39	Köln-Alteburg	<p>Fleet base (fort).</p> <p>The fort was located about 3 km south of the CCAA on a flood-free natural plateau directly on the bank of the river Rhine. The river has the same course today. The fleet base was an irregular pentagon in shape, surrounded by a single ditch. Gates are attested for the northern, western and southern sides; a fourth gate is very likely on the eastern side (probable harbour) but has not so far been confirmed. In its first phase (c. AD 10), the fort had a earth-and-timber rampart that was replaced by a stone wall about 0.8 m wide in the late 1st century AD. A very unusual feature is the complete absence of interval towers on both earth-and-timber and stone defences. The stone fort was a little larger than its predecessor on its western side, but the overall shape was retained; the maximum dimensions were 362 m (NW to SE) resp. 258 m (W to E), covering an area of c. 7.3 ha.</p> <p>Most of the interior buildings known so far are east-west orientated barracks with an inner layout that is different from other fortifications, be it legionary or auxiliary. This presumably indicates a different and particular organisation of the auxiliary forces of the Roman fleet. In the first phase the barracks were constructed in wood, replaced later by timber-framed outer walls on stone foundations. Between the barracks were gravelled roads. In the centre of the fort, at the crossing of the two main roads, a headquarters building (lat. <i>principia</i>) has been detected just recently by geophysical survey. It seems to have been rebuilt in stone as early as the reign of Nero (AD 54–68) – a feature that normally is to be found only in legionary fortresses. Around 85, the whole fort was rebuilt in stone.</p> <p>Representing a paradigm change in the military defence strategy along the Rhine border, the Alteburg fort was built to accommodate over 1,000 soldiers, both fleet and combat forces. The main gate (lat. <i>porta praetoria</i>) opened to the river, underlining the monumental aspect of the fleet base. The fort was in use for more than 200 years with nine building phases, reflecting the long-term development of the Roman army. Its abandonment in the 3rd century reflects the major reorganisation of the Roman army in crisis.</p>
40a	Kottenforst Nord Am Weißen Stein 1	<p>Temporary camp.</p> <p>A manoeuvring area of the Bonn Legion is located in the hinterland of Bonn, on the high plains of the Ville in the northern Kottenforst. 12 temporary camps with a size of 0.5 to 1.9 ha form a cluster. Orientated partly in rows or with the same orientation, they relate to each other. There is no overlap between them. The defences of the camps consist of an earthen rampart, typical for Roman marching camps. These earthen ramparts were constructed using curves (lat. <i>caespites</i>) stacked to form a wall. The gates are without exception in the form of <i>claviculae</i> (literally keys). This special method of fortification is easily legible in the field today.</p>
40b	Kottenforst Nord Am Weißen Stein 2	<p>Temporary camp.</p> <p>For a general description cf. component part 40a.</p>
40c	Kottenforst Nord Domhecken 5	<p>Temporary camp.</p> <p>For a general description cf. component part 40a.</p> <p>This camp probably also belongs to the cluster of 40d–g.</p>
40d	Kottenforst Nord Domhecken 1	<p>Temporary camp.</p> <p>For a general description cf. component part 40a.</p> <p>This camp is strongly connected to 40e, 40f and 40g. They are arranged fan-shaped in always 10° difference to each other.</p>
40e	Kottenforst Nord Domhecken 2	<p>Temporary camp.</p> <p>For a general description cf. component part 40a.</p> <p>This camp is strongly connected to 40d, 40f and 40g. They are arranged fan-shaped in always 10° difference to each other.</p>
40f	Kottenforst Nord Domhecken 3	<p>Temporary camp.</p> <p>For a general description cf. component part 40a.</p> <p>This camp is strongly connected to 40d, 40e and 40g. They are arranged fan-shaped in always 10° difference to each other.</p>

id	name	brief description
40g	Kottenforst Nord Domhecken 4	Temporary camp. For a general description cf. component part 40a. This camp is strongly connected to 40d, 40e and 40f. They are arranged fan-shaped in always 10° difference to each other.
40h	Kottenforst Nord Dürrenbruch 3	Temporary camp. For a general description cf. component part 40a. This camp is strongly connected to 40i and 40j. They are orientated to each other.
40i	Kottenforst Nord Dürrenbruch 2	Temporary camp. For a general description cf. component part 40a. This camp is strongly connected to 40h and 40j. They are orientated to each other.
40j	Kottenforst Nord Dürrenbruch 1	Temporary camp. For a general description cf. component part 40a. This camp is strongly connected to 40h and 40i. They are orientated to each other.
40k	Kottenforst Nord Pfaffenmaar 1 and 2	Temporary camps. For a general description cf. component part 40a. These camps are strongly connected to each other. They are parallel to each other and share the direction of the <i>via principalis</i> .
41	Bonn	Legionary fortress. The Bonn legionary fortress, which existed for about 400 years, is located directly beside the Rhine in a flood-free area. To the west, the plateau was bounded by a small river, the Gumme. The almost square legionary fortress was built by <i>legio I (Germanica)</i> around AD 35 under the Emperor Tiberius. At 27.8 ha it is one of the largest within the Roman Empire. Following <i>legio XXI rapax</i> , <i>legio I Minervia</i> was based here as the main legion from AD 83 for more than 200 years. In the eastern part of the fortress were large storage buildings (lat. <i>horrea</i>). They were conveniently located close to a gate which provided access to the waterfront, where most goods were delivered via the Rhine. In Late Antiquity, the wall of the legionary fortress was reinforced and widened to 2.5 m and an 11–13 m wide ditch was built. The garrison was reduced at this time. Nonetheless, the size of the Bonn legionary fortress remained unchanged throughout its life.
42a	Kottenforst Süd Oben der Krayermaar	Temporary camp. A manoeuvring area of the Bonn Legion lies in the hinterland of Bonn, on the high plains of the Ville in the northern Kottenforst. 10 temporary camps 0.5 to 1.9 ha in size form a cluster. Oriented partly in rows or with the same orientation, they relate to each other. They do not overlap. The defences of the camps consist of an earthen rampart, typical for Roman marching camps. These earthen ramparts were constructed using turves (lat. <i>caespites</i>) stacked to form a wall. The gates are without exception in the form of <i>claviculae</i> (literally keys). This special method of fortification is easily legible in the field today.
42b	Kottenforst Süd Villiper Bach	Temporary camp. For a general description cf. component part 42a.
42c	Kottenforst Süd Professorenweg 1	Temporary camp. For a general description cf. component part 42a.
42d	Kottenforst Süd Professorenweg 2	Temporary camp. For a general description cf. component part 42a.
42e	Kottenforst Süd Riesenweg	Temporary camp. For a general description cf. component part 42a.
42f	Kottenforst Süd Wattendorfer Allee 2	Temporary camp. For a general description cf. component part 42a.
42g	Kottenforst Süd Wattendorfer Allee 1	Temporary camp. For a general description cf. component part 42a.
42h	Kottenforst Süd Bellerbuschallee	Temporary camp. For a general description cf. component part 42a.
42i	Kottenforst Süd Villiprot	Temporary camp. For a general description cf. component part 42a.
42j	Kottenforst Süd Heiderhof	Temporary camp. For a general description cf. component part 42a.
---	Königswinter-Drachenfels	(Roman?) Stone quarry. The mountain of 'Drachenfels' on the right bank of the Rhine is formed from trachyte, a rock formation with a very distinctive pattern making it easy to identify stone building materials from this source. The use of this specific rock formation for building materials in Roman times is attested at many buildings along the river Rhine. Traces of past manual stone extraction in the form of wedge-holes are preserved at several locations, but their Roman dating has not so far been proven.
43	Iversheim	Lime kilns. The nominated property is located on the northern edge of the Sötenicher Kalkmulde. These limestone deposits are the most northerly in the Rhineland that were known in Roman times, on the left bank of the Rhine.

id	name	brief description
		Six lime kilns are located in a large hall with dimensions of approx. 30 × 6 m. Four to five of the kilns were in use during different periods and produced up to 200 tons of quicklime per month, used for the construction of large buildings and other structures in the Province of <i>Germania inferior</i> . The industrial installation was probably used from at least the 1 st century to the end of the 3 rd century AD and underwent several modifications and reconstructions. The complex is also unusual in that it comprises not only the kilns and the industrial hall, but also associated structures for the accommodation of soldiers and the storage of material. The decisive factors for the location were not only the occurrence of limestone, but also the availability of fire wood and access to water. Transport of the finished products was probably via the Erft into the Rhineland.
44	Remagen	Auxiliary fort. At the centre of the complex is an auxiliary fort dating back to the time of Augustus (Phase 1). An earth-and timber-fort with an encompassing ditch was built in the time of Tiberius-Claudius (Phase 2). The fort was destroyed in AD 69 during the Batavian revolt, but immediately rebuilt in stone to the same plan as before (Phase 3). A further reconstruction, or rather a strengthening, of the fort took place between AD 270/280 and the Constantinian period (Phase 4). The Late Antique walls were constructed on the existing walls of the stone fort. The fortifications of the early and middle Empire (Phases 2 and 3) were integrated into the later defences and continued to be used into Late Antiquity.

2.a.5 Selection process and overview of component parts

Over a hundred military installations are known or supposed to have existed within the territory of the province of Lower Germany and in its foreland across the river Rhine. Half of them were positioned on the left bank of the river, while the others were distributed over the foreland, the hinterland and the North Sea coast. For the nomination of *Frontiers of the Roman Empire – The Lower German Limes* 106 component parts have been selected.



Fig. 2.30 Section through the silted-up channel of the Roman Rhine at Alphen aan den Rijn. The dark area with the collapsed embankments dates to the Roman period, the lighter fine-layered upper fill is medieval.

The process of selection of sites for the proposed nomination of *Frontiers of the Roman Empire – The Lower German Limes* was first of all guided by the so-called Koblenz Declaration of 2004: ‘The Frontiers of the Roman Empire World Heritage site should consist of the line(s) of the frontier of the height of the empire from Trajan to Septimius Severus (about AD 100–200), and military installations of different periods which are on that line. The installations include fortresses, forts, towers, the Limes road, artificial barriers and immediately associated civil structures.’⁶ This declaration was adopted by the States Parties involved in the process of nominating sections of the frontiers of the Roman Empire in Europe, and was maintained as a guideline for future nominations in the Thematic Study for the Frontiers of the Roman Empire presented to the World Heritage Committee in 2017.⁷ Application of this declaration to the Roman province of Lower Germany and its foreland implied a focus on the river Rhine, which was the line of the frontier in the 2nd century AD in this area.

The three frontier sections which have been inscribed on the World Heritage List under the joint heading of *Frontiers of the Roman Empire* – Hadrian’s Wall in England (1987), the Upper German-Raetian Limes in Germany (2005) and the Antonine Wall in Scotland (2008) – are all continuous artificial barriers. For these three component parts the linear barrier – stone wall, timber palisade, earthen rampart, ditch – is an important element of the nominated property. The military

⁶ Nomination file 430ter, p. 427.

⁷ R. Ployer/M. Polak/R. Schmidt, *The Frontiers of the Roman Empire – A Thematic Study and Proposed World Heritage Nomination Strategy*. Advised by ICOMOS-International and commissioned by the Intergovernmental Committee of the ‘Frontiers of the Roman Empire’ World Heritage Site (UK, DE) and the Bratislava Group (Vienna, Nijmegen, Munich 2017). Cf. decision 41 COM 8B.50.

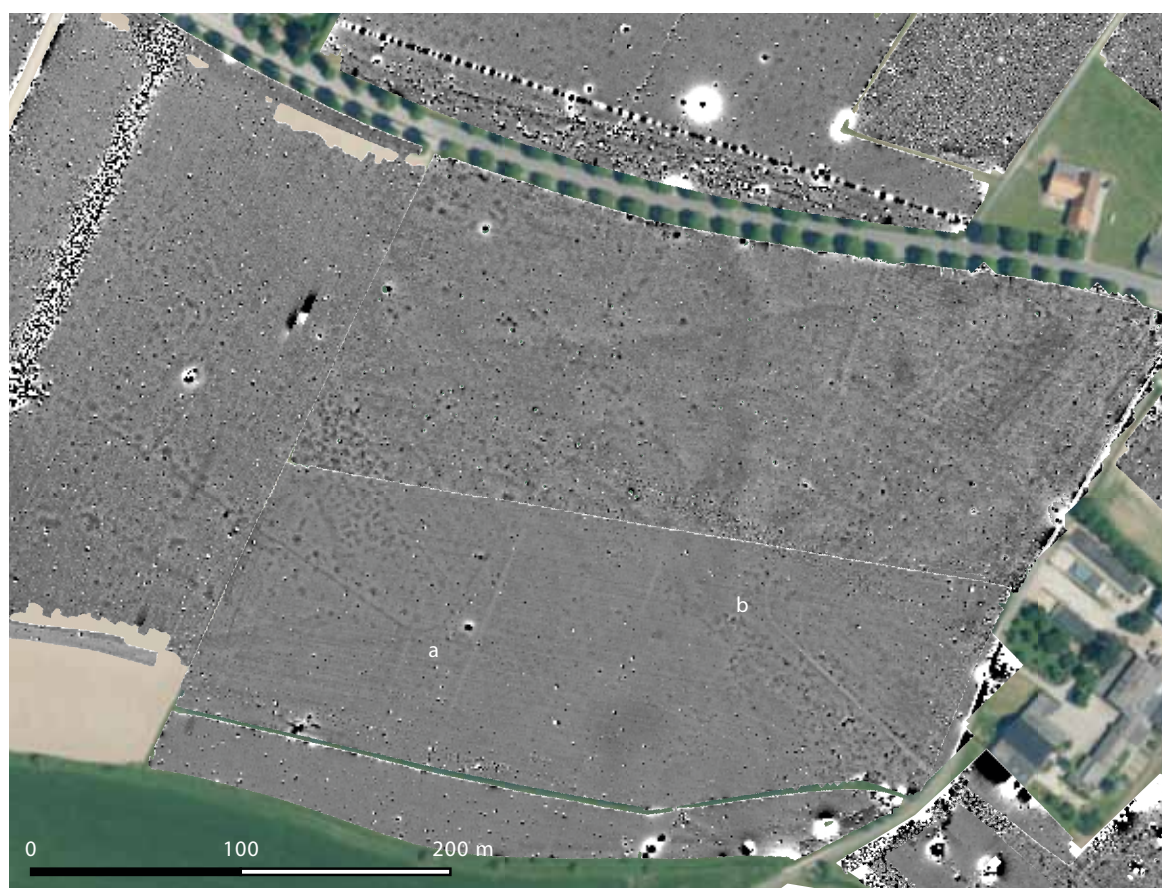


Fig. 2.31 Results of the geophysical surveys carried out at Till ► 22. Corner of a large marching camp with a single ditch (a) and corner of a fortress with several ditches (b).

installations on the left bank of the Rhine, however, were essentially connected by the river, and only at a later stage additionally by a road. Since the Roman period the Rhine has shifted its course in many places, so the river of today is not a useful representation of its Roman predecessor (fig. 2.30). Furthermore, the location of the river channel in the Roman period is not always known, and in some areas it has been eroded by later river bend migrations. The Limes road connecting the forts is not known in its entirety, and the state of preservation of several attested parts does not meet the requirements for nomination. Neither the river nor the Limes road can therefore be parts of a nominated property in their entirety. *Frontiers of the Roman Empire – The Lower German Limes* is therefore nominated as a serial property, with its separate elements constituting the pearls on a necklace.

As the site selection should express the linear character of the frontier, it should be of sufficient size, and the selected sites should be adequately distributed. Furthermore, they should be able to convey the proposed Outstanding Universal Value, be in a good condition and not subject to significant threats. These requirements were the basis of a further two stage selection process. In the first stage, separate, provisional selections were made for sites in Germany and in the Netherlands. In the second stage the two provisional selections were subjected to a joint assessment, evaluating the contribution of all individual sites to the

overall proposed Outstanding Universal Value.

In Germany the project ‘Zustandserfassung und Inventarisierung des Niedergermanischen Limes’ (record and inventory of the Lower German Limes) was started in 2005 to provide a complete as possible, up-to-date GIS-based inventory of more than 200 proven or suspected Roman military sites in North Rhine-Westphalia as the basis for further selection. The joint Dutch-German expert meeting ‘The outstanding universal value and the feasibility of a joint nomination as a World Heritage site of the Lower German Limes – Limes Germaniae inferioris’ held in Xanten in 2010 led to a better understanding of the criteria for the selection process and highlighted the value of the concept of a ‘wetland frontier’ with all its different aspects.

This approach was further elaborated in a first draft of a Statement of Outstanding Universal Value and a comparative analysis in 2014.⁸ With reference to this draft, a total of 27 sites/site clusters was compiled for the German section of the Lower German Limes between Remagen and Till as part of the re-evaluation of the German Tentative List entry in 2014. To provide a better understanding of the archaeological remains at these sites for the definition of the property and

⁸ W. J. H. Willems/E. Graafstal/C. van Driel-Murray, Draft Statement OUV & Comparative Analysis World Heritage Nomination Lower German Limes (Leiden 2014).

Fig. 2.32 Trial trench at the Herwen-De Bijland ► 19, excavated in November 2018 to verify the results of a coring survey. View from the southwest.



buffer zones and to evaluate some probable sites, a combined investigation programme of geophysical research, aerial survey and trial trenches was conducted at various sites in 2015. This led to a better understanding of previously known sites and the discovery of a hitherto unknown auxiliary fort at Alpen-Drüpt and of a new camp at Keeken. Within the international research programme 'Harbours from the Roman period to the Middle Ages', many sites and sections along the Roman river were investigated between 2012 and 2018, leading to a better knowledge of the palaeogeographic context of the riverine landscape. In 2015, a large-scale magnetometer-survey programme was started at four locations to provide a better understanding of the concept of a military landscape, resulting in many new discoveries of military installations and associated elements. One site (Kalkar-Monreberg) was proven to be a pre-Roman fortification rather than an early Roman camp and was deselected (fig. 2.31). Eventually, 29 sites/site clusters were listed in the updated Tentative List entry in 2018.

Since 2014, the total number of sites has increased as a result of three new discoveries which contribute to the Outstanding Universal Value (Kleve-Keeken, Kleve-Reichswald, Alpen-Drüpt), while three sites have been deselected since 2014 following re-evaluation of their dating (Königswinter-Drachenfels, Kalkar-Monreberg) or because of inadequate authenticity and integrity (Alpen-Boenninghardt). The selection included

in this nomination reflects a decrease to 24 sites/site clusters based on the merging of former individual elements within combined clusters.

In the Netherlands a first selection was made in 2012.⁹ A grouping of 233 sites located within an area which had been demarcated by the Cultural Heritage Agency of the Netherlands as the Dutch section of the Lower German frontier zone was reduced to a provisional selection of 119 sites. In 2014 the selection was further reduced to 72 sites, grouped in 42 clusters. Additional information was provided for each site,¹⁰ making use of the first draft of the Statement of Outstanding Universal Value compiled in the same year.¹¹

In 2015 the situation was evaluated by an international committee appointed by the Ministry of Education, Culture and Science of the Netherlands,¹² which concluded that the selection of sites and the definition of their boundaries were at times debatable. To improve the site selection an academic assess-

⁹ W. A. M. Hessing/B. Brugman/W. J. Weerheijm/L. Ziengs, Voorstel voor een kader voor de verankering van de Romeinse Limes in de provinciale ruimtelijke verordeningen van de provincies Gelderland, Utrecht en Zuid-Holland (Amersfoort 2012).

¹⁰ K. M. van Dijk, Terreinencatalogus voor de werelderfgoednominatie Romeinse Limes (s.l. 2014).

¹¹ Cf. note 8.

¹² For the latter cf. Bitter en zoet. Advies van de Expertgroep beoordeling werelderfgoednominaties (s.l. 2015).

ment was carried out in 2016, which started with the earlier 'long list' of 233 sites, evaluated these against the background of the draft Statement of Outstanding Universal Value, and subjected the resulting selection of 23 sites/site clusters to an internal comparative analysis.¹³ Additional field work was recommended for ten sites, to collect more evidence concerning the presence, character, preservation and extent of the archaeological remains. These recommendations resulted in eight desktop studies, two geophysical surveys, five coring surveys and six excavations in the form of trial trenches, all carried out in 2017–2019. The outcomes of these research projects led to a further reduction in the selection. Four sections of the Limes road, which turned out to be insufficiently preserved, and the fort of Bodegraven, the form and size of which could not be established, were removed from the list (fig. 2.32).

As a result of the selection process outlined above, the nominated property *Frontiers of the Roman Empire – The Lower German Limes* consists of 106 component parts, 79 of which are grouped in 17 clusters. An overview of the component parts and the elements of the frontier represented by them is provided in table 2.1. This table also includes the most relevant of those elements which have been considered for nomination but rejected; these elements are not preceded by a number and are not further discussed in this dossier.

The selected component parts and clusters are presented in detail in the catalogue of component parts (Annex 1), where their main characteristics and their contribution to the proposed Outstanding Universal Value may be found under the headings 'Brief description' and 'Attributes and values'.

2.b History and development

In order to understand the development of the Lower German Limes it is necessary to have some idea of the wider context of the Roman Empire and its frontiers. This is summarised in section 2.b.1. The history of the Lower German frontier is outlined in section 2.b.2. After the abandonment of this frontier in the 5th century AD most of the installations decayed and disappeared from sight, until they were 'rediscovered' in the 16th century. Our knowledge of the military infrastructure and the present state of the remains are influenced by the gradual development of scientific archaeology and of measures taken for their protection and presentation. These aspects are briefly discussed in section 2.b.3.

2.b.1 The Roman Empire and its frontiers

Rome started off as a kingdom, was converted into a republic c. 500 BC, ending with the murder of Julius Caesar in 44 BC after a series of civil wars. The appointment of his adoptive son as a head of state in 27 BC is considered as the start of imperial rule, which would last for five centuries in the West and fifteen in the East. From c. 250 BC onwards Rome gradually expanded its power outside Italy, initially over the relatively developed societies surrounding the Mediterranean Sea, but from c. 50 BC onwards increasingly over more remote areas with less centralised traditions. At the same time military control of the annexed areas moved from the interior to the external boundaries. As the offensive made way for the defensive, large expeditionary armies were redeployed into smaller units spread out over the frontier lines.

According to historical tradition Rome was founded in 753 BC. The city was initially ruled by elected kings, but misgovernment led to the expulsion of the last king c. 509 BC and to the establishment of what we know as the Roman Republic, led by two annually elected consuls. In the following centuries Rome gradually expanded its power in Italy by concluding treaties with other cities and by applying brute military force where diplomacy failed. By the middle of the 3rd century BC all of Italy was under Roman control.

The expansion into southern Italy and to the island of Sicily brought Rome into conflict with the other main powers in the Mediterranean: the city state of Carthage on the African coast and the kingdoms of Greece. After several hard-fought victories Rome had annexed most of the coastal regions of the Mediterranean Sea and converted these into provinces of the Republic. The conquest and exploitation of these areas generated great military prestige and immense wealth for some members of the c. 25 families that constituted the ruling elite. Their internal rivalry and the increasing imbalance within the Roman society uprooted the republican system, culminating in the dictatorship of Julius Caesar, his murder by political rivals in 44 BC and the appointment of his adoptive son Octavian as head of state with the honorary title of Augustus ('venerable') in 27 BC (fig. 2.33). This date is now considered as the start of imperial rule or Principate (derived from *princeps*, 'leading citizen').

When Nero, the last descendant of the Julio-Claudian dynasty of Augustus, died in AD 68, a civil war broke out which might have put an end to the imperial model, but Vespasian managed to restore order in AD 69, founding the Flavian dynasty. After his youngest son Domitian had been assassinated in AD 96, imperial succession was for almost a century arranged by adoption, followed by the rule of the Severan dynasty after a brief civil war. When the last member of the

¹³ M. Polak/J. de Bruin, *The Lower German Limes. Scientific assessment of the site selection for the 'Frontiers of the Roman Empire' World Heritage Site* (Nijmegen 2016).



Fig. 2.33 Miniature glass head of Augustus. Today in the Römisch-Germanisches Museum of Köln.

Severan house was murdered in AD 235 the Roman Empire was faced with a deep crisis. The next fifty years saw more than twenty more or less legitimate emperors and at least as many usurpers, most of them ambitious army commanders. Around AD 270 the Empire even fell apart briefly, into three competing empires: the Gallic Empire in the West, the Palmyrene Empire in the East and the remaining part of the Empire centred around Italy.

The chaos produced by this imperial competition, in which frontier garrisons were used as pawns, paved the way for invasions from outside the Empire, on the Rhine and Danube, in the East and in large parts of northern Africa. From the Black Sea to the North Sea the military infrastructure was destroyed or otherwise affected; in the East the army suffered humiliating losses, and in Egypt and Africa large areas were overrun. It was only in the final years of the 3rd century AD that order was restored, after Diocletian had divided the Empire into a western and an eastern part, sharing the burden of imperial rule with Maximian and two junior emperors. The division of the Empire and of the imperial power was maintained for much of the 4th and 5th centuries, but the system suffered heavily from conflicts over succession. During the 5th century, increasingly, emperors of the West were not recognised by those of the East, until the Roman West finally dissolved c. AD 480. The Eastern Empire continued to exist for nearly a millennium, usually referred to

as the Byzantine Empire after its capital *Constantinopolis*, formerly named *Byzantium*.

During the Republic the Roman armies operated mainly around the Mediterranean Sea, in areas with developed hierarchical societies. These regions could be controlled by posting army regiments in the interior, in or near the major cities and other central places. From the late 1st century BC onwards, on moving further inland, the Roman armies were increasingly faced with less centralised and often migratory societies. Subjection, military control and civil administration of their territories was very difficult, as Rome experienced in areas as far apart as the German Rhineland and the deserts and semi-deserts of Arabia and Africa. As the troops advanced more and more into economically marginal areas whose carrying capacity was insufficient for the maintenance of a large army, supply was an increasing challenge. In many regions the expansion therefore came to a standstill.

When the societies outside the annexed areas could not be controlled by treaties, the armies were pushed out from the interior to the external boundaries of the newly acquired territories. The Lower Rhine was the first area where this development took place, but other areas soon followed. The transition to perimeter defence in the course of the 1st century AD is reflected by the gradual disappearance of bases for more than a legion, the swift increase in forts for units of a thousand or less troops, the conversion of earth-and-timber fortifications into stone ones, and the establishment of a network of metalled roads.

In the early 2nd century AD the Roman Empire reached its greatest extent, with linear arrangements of military installations along its boundaries in most areas. This development culminated in the creation of the continuous artificial barriers of Hadrian's Wall and the Antonine Wall in Britain and the Upper German-Raetian Limes in southwest Germany. This defence system provided cost-effective and adequate protection against raiding and other small-scale threats. Larger threats were countered by ad hoc armies, preferably beyond the frontier line.

The reduction of the frontier garrisons during the crisis of the 3rd century and the development of large tribal formations such as the Franks, the Alamanni and the Goths beyond the Rhine and Danube led to sustained attacks on several frontier sections. Where the line was broken, invaders penetrated deeply into the Empire. Although the linear defence was subsequently restored in many places, the frontier installations were reduced in number and size. New and restored forts were much more massive than their predecessors, characterised by projecting towers for the effective use of artillery (fig. 2.34). Additionally, new strongholds were built along the roads leading into the interior of the Empire. These were intended to slow the pace of invaders in anticipation of the ar-

rival of a large mobile army stationed in the rear. The increased risks for the provincial population led to the building of city walls and the fortification of farmhouses and granaries.

The conquests of the Roman Republic had been fought by ad hoc legions recruited from small peasants in Italy, and by so-called auxiliary forces provided by Italian allies, subject tribes and occasionally mercenaries. Augustus greatly reduced the number of legions which had been raised during the civil war at the end of the Republic. He created a professional standing army of c. 30 legions or c. 150,000 men, supplemented with a similar number of auxiliary soldiers. Initially, the troops were divided between the periphery of annexed territories and areas in the interior needing further pacification. The concentration of the armies on the external boundaries into large bases demonstrates that they were not intended as frontier garrisons, but rather as strike forces for further conquests. In the course of the 1st century AD, as linear defence started to develop, the large expeditionary armies were dissolved. Single legions were stationed at strategic locations, but frontier security was primarily left to mobile auxiliary units spread out along the perimeter. Flexibility of deployment was increased by the creation of so-called military units of 1,000 men and *numeri* of possibly 300 men, as supplements to the legions of 5,000 men and the regular auxiliary units of 500 men.

Army units were frequently relocated as long as the Empire was expanding, but when the frontier lines solidified in the 2nd century AD mobility was greatly reduced. Armies for large wars were increasingly assembled by drafting detachments from legions, instead of entire legions.

The rearrangement of the military infrastructure from the late 3rd century onwards went hand in hand with a restructuring of the army. The changes included a reduction in size of the legions and the creation of large mobile armies as a flexible complement to the now reduced frontier garrisons.

2.b.2 History of the Lower German Limes

The earliest known military base in the Rhineland was built in 19 BC. For over three decades, military campaigns across the Rhine and diplomatic measures failed to solve the problem of unrelenting Germanic invasions into Gaul. In AD 17, the Roman armies were withdrawn from east of the Rhine and military installations developed along the left bank, forming the first linear frontier of the Empire. For over two centuries the Lower German Limes proved an effective instrument of Roman frontier defence, with the exception of a near collapse during the civil war of AD 68–69. During the 3rd century the frontier shared in the general political and eco-



mic crisis, with a prominent role in the temporary breakaway known as the Gallic Empire. Despite several restorations in the 4th century, the frontier was eventually abandoned after the middle of the 5th century.

Although it is certain that the armies of Julius Caesar operated in the Rhineland during the Gallic War of 58–52 BC, the camps which they must have built in this area have not, so far, been recognised. The transformation of the conquered Gaulish territories into three Roman provinces – (*Gallia*) *Lugdunensis*, *Aquitania* and *Belgica* – took several decades. The process of provincialisation was retarded by the civil wars which led to the end of the Republic and the creation of the Principate, by tribal revolts in Gaul and by Germanic invasions. The latter were countered by punitive expeditions and it was during one of these campaigns that the earliest known military base in the Rhineland was built, at Nijmegen-Hunerberg ►15 in 19 BC. On the same occasion some pro-Roman Germanic groups were displaced to the left bank of the Rhine, to repel further attacks from the east.

When repeated invasions demonstrated the inadequacy of this new security arrangement, the Emperor Augustus (fig. 2.35) turned to large-scale war across the Rhine. From 12 BC onwards nearly a quarter of the entire Roman army was on campaign in Germany as far as the river Elbe – 500 km east of the Rhine. Several nodes in the logistical system were secured by military posts, as at Bunnik-Vechten ►11 and Moers-Asberg ►30. The scale and range of the operations indicate clearly that Rome intended to incorporate this vast area as a Roman province. Although resounding victories were won, peace rarely lasted more than a few years. Treaties were violated time and again, and even the deportation of tens of thousands of notorious troublemakers to the left of the Rhine failed to create a stable situation. In AD 17 Tiberius ordered the withdrawal of the armies to the left bank of the river. The military infrastructure was extended with

Fig. 2.34 Projecting towers, as attested at the east gate of the Late Roman bridgehead fort of Köln-Deutz ►38 for instance, provided enough space to mount artillery. Today, the layout of the gate is marked out with masonry erected on top of the actual features.

several bases, including a fleet base at Köln-Alteburg ►39 and smaller posts such as Kalkar-Bornsches Feld ►24 and Alpen-Drüpt ►29.

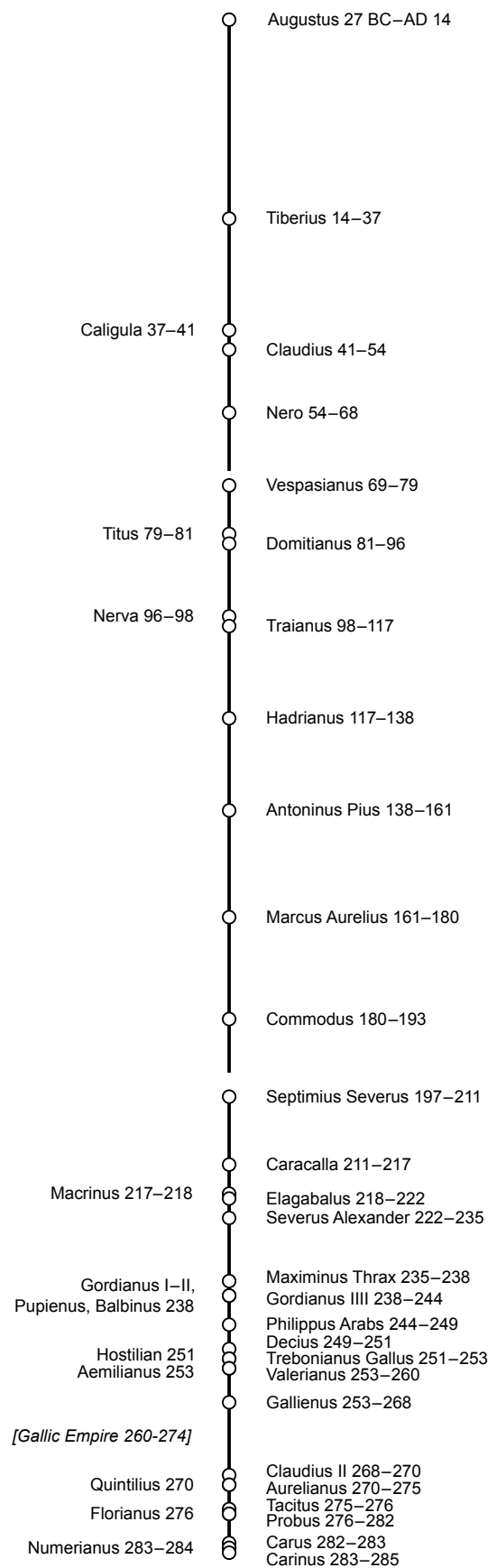


Fig. 2.35 Roman Emperors from Augustus to Carinus with their respective dates of reign.

The Emperor Gaius (AD 37–41), better known as Caligula, resumed the aggressive military policy of Caesar and Augustus. After a brief display of power beyond the Rhine he prepared to cross the English Channel to Britain, but the plan was cancelled at the last minute. Judging by the immediate establishment of a dense series of small forts such as Valkenburg-Centrum ►1 and Utrecht-Domplein ►10 in the Rhine delta – clearly intended to protect this vital supply line to Britain against Germanic piracy – the invasion was not abandoned, but only postponed to allow for better preparation. In AD 43 Claudius (AD 41–54) carried through the initiative begun by his predecessor, and it is highly likely that his rapid advance in Britain owed much to Caligula's preparations (fig. 2.36).

In AD 47 the ambitious military commander Corbulo embarked upon recapturing Germanic territories across the Rhine, but he was whistled back by Claudius, who must have recognised the risks of a war on two fronts. After redeploying his troops on the left bank of the river, Corbulo ordered the construction of a canal ►4 connecting the Rhine and Meuse behind the coastal barriers, 'to keep his troops busy' as the historian Tacitus wrote, and 'to avoid the hazards of the ocean'. At about the same time the ramparts and the main inner buildings of the legionary fortresses of Xanten-Fürstenberg ►28 and Neuss-Koenenlager ►33, previously constructed in timber, were rebuilt in stone. This is a further indication that the series of military installations along the left bank of the Rhine was now considered to be a permanent frontier line. Nevertheless, parts of the east river bank were still claimed as Roman military territory. This is demonstrated by the harsh eviction under the rule of Nero (AD 54–68) of Frisian and Ampsivarian settlers from the right bank of the river, recorded by Tacitus. Archaeological evidence of a continued Roman claim on the right bank is provided by the exploitation of a stone quarry at the Drachenfels opposite Bonn and of a *tegularia transrhenana* ('brick works across the Rhine').

The death of Nero and the ensuing civil war of AD 68–69 brought an end to compliance with Roman rule by three generations of the Germanic tribes that had been transferred to the left bank of the Rhine during the reign of Augustus. The acting commander of the Lower German army was the second of four consecutive claimants to the imperial purple. He left for Italy with troops of the Lower and Upper German armies, who had acclaimed him as emperor. The weakened army on the Lower Rhine was thereupon assaulted by a federation of Gaulish and Germanic tribes, with a prominent role for the Batavians, settled in the river delta west of Nijmegen, and for the auxiliary units recruited from amongst them. All the camps on the Rhine were destroyed by fire, either when hastily evacuated by their garrisons or when captured by



Fig. 2.36 Brandmarks with the abbreviated names of the Emperor Caligula on staves of wine barrels found at Valkenburg (a) and Vechten (b).

the rebels (fig. 2.37). The uprising is likely to have been encouraged by Vespasian (AD 69–79), the fourth candidate for the purple. Once Vespasian's position on the imperial throne was secured, one of his generals succeeded in quelling what has become known as the Batavian revolt, in AD 70. The restoration of order was sealed by the establishment a new legionary fortress at Nijmegen-Hunerberg ▶15.

The reign of Vespasian's second son Domitian (AD 83–96) constituted a turning point in the history of the Lower German Limes. A war with the Germanic Chatti was formally concluded with a triumph in Rome *de Germanis*, 'over the Germans', i.e. the Germans at large. The victory was thus presented as the final conclusion of the wars which had started nearly a century before. The Upper and Lower German military districts were now transformed into Roman

provinces. This somewhat forced arrangement was probably connected with an incursion by the powerful Daci across the river Danube. To counter this invasion, troops were ordered from other provinces including Lower Germany. Most of the displaced units seem to have returned to their bases, but the building of a new fort at Dormagen ▶36 may point to some rearrangements.

Following his assassination, Domitian was briefly succeeded by the elderly Nerva (AD 96–98), who adopted a man from outside his family as his intended successor, as the first of four consecutive emperors. When Nerva died this adoptive son, the able general M. Ulpius Traianus (AD 98–117), was residing in the *prae-torium* at Köln ▶37 as acting governor of Lower Germany. Trajan's first actions as emperor included the foundation of the *Colonia Ulpia Traiana* at Xanten and



Fig. 2.37 Horse burial from Krefeld-Gellep ▶32 on the battlefield of AD 69.

the promotion of the civil settlement at Nijmegen to *Ulpia Noviomagus*, probably as early as AD 98 or 99. A few years later the legionary base at Neuss ►33 was replaced by an auxiliary fort, and the legion at Nijmegen-Hunerberg ►15 appears to have been replaced with detachments only. The number of auxiliary units was also decreased, and the evacuation of the fort at Moers-Asberg ►30 may be related to these measures. In all, the Lower German army was reduced by nearly fifty percent in the first quarter of the 2nd century AD. The Limes road in the Rhine delta was twice repaired on a large scale, in AD 99/100 and 123/125, as firmly attested at Utrecht-Limes road ►7. It is tempting to consider all these measures as elements of a coherent plan to mitigate the negative effects of the troop reduction, but there is no clear evidence of a causal connection between these successive events. There is, however, little doubt that the reduction of the Lower German army was in some way related to the Dacian Wars of AD 101–102 and 105–106, which resulted in the creation of the new province of *Dacia*. This led to a large-scale and permanent redeployment of army units, to the Danube or to other frontiers, succeeding regiments which had been displaced for the Dacian Wars (fig. 2.38).

From the late 1st century BC to the early 2nd century the army had been very mobile. Legions and auxiliary

regiments were constantly relocated to fight wars and to man the gradually developing external frontiers. The incessant transfers are mirrored by the frequent rebuilding of military installations, which was necessary to accommodate new units of different sizes and compositions than the previous ones, or to respond to changing strategies. The reign of Hadrian (AD 117–138) brought a radical change. Trajan's wars in *Dacia* and the East had overstretched the capacities of the Roman army. Hadrian therefore evacuated most of the recent acquisitions in the East and consolidated the remaining frontiers. From then on army units left their bases only periodically for military campaigns elsewhere; large numbers of temporary camps as at Uedem-Hochwald ►25 and Wesel-Flüren ►26 demonstrate that training for military campaigns was a constant concern. If expeditionary forces were needed, they were usually composed of detachments of legions and auxiliary units, which returned to their bases after the conclusion of a war.

For most of the 2nd century it appears to have been relatively quiet on the Lower Rhine, with only a record of Germanic raiding into nearby *Gallia Belgica* in the early 170s AD and perhaps a further unspecified Germanic invasion under Commodus (AD 180–193). After the assassination of Commodus the Empire was dragged into a succession war which lasted for five



Fig. 2.38 Inner face of a military diploma found at Elst, issued to a Batavian horseman on his release from the auxiliary forces of the Roman army. The document lists nearly all auxiliary units present in Lower Germany in February AD 98.

years (AD 193–197). The Lower German army may have been involved in the conflict, but any battles were fought outside the province.

The nearly forty years of the reign of the Severan dynasty (AD 197–235) heralded the crisis of the 3rd century. The rule of the Severi was interrupted when the commander of the imperial guard murdered the Emperor Caracalla (AD 211–217) and appropriated the purple for just over a year – foreshadowing the numerous military usurpations during the remaining history of the Western Empire. Further, the reign of Caracalla saw the start of protracted conflicts on the Rhine with new federations of Germanic tribes – the Alamanni on the Middle Rhine and the Franks on the Lower Rhine. Initially, the involvement of Lower Germany appears to have been limited to the supply of troops for military operations further south, where the Upper German-Raetian Limes was overrun in AD 233. The invaders were defeated a few years later. From then on the garrisons of the Lower German Limes were thinned out to participate in the power struggle between successive emperors and usurpers and in repeated wars on the Danube and in the East.

From AD 256 onwards Lower Germany suffered from attacks by the Franks. Shortly afterwards Köln became the capital of the so-called Gallic Empire, established in AD 260 by the usurper Postumus (AD 260–268), who was an army commander in Lower Germany. The Gallic Empire included both German provinces, most of Gaul, and Britain and Spain. Postumus and his successors seem to have had their share of Germanic troubles, which must have included piracy, as coins with depictions of a warship indicate. After a military victory in AD 274 the Gallic Empire was dissolved by the officially recognised emperor of the Western Roman Empire.

It is unclear whether the Lower German Limes was affected by the German attacks of AD 275/276. It has long been thought that these led to a large-scale destruction of the military infrastructure along the Rhine and Danube, but this assumption is now subject to much debate, not least because of the virtual absence of destruction layers from this period. Political and military instability went hand in hand with a deep economic crisis, in which increasing taxes to finance the military apparatus and buying off invaders were important factors. The crisis is likely to have been aggravated by climate change resulting in hot summers and extremely cold winters and by soil erosion caused by agricultural overexploitation and extensive felling of forests. The scarcity of finds at many military sites in the 3rd century, which led to the assumption of reduced military activity, may therefore rather be an effect of the economic crisis. On the whole, there are no signs of significant destruction or abandonment of military installations along the Lower German Limes in this period, but in Xanten-CUT ►27 the south-

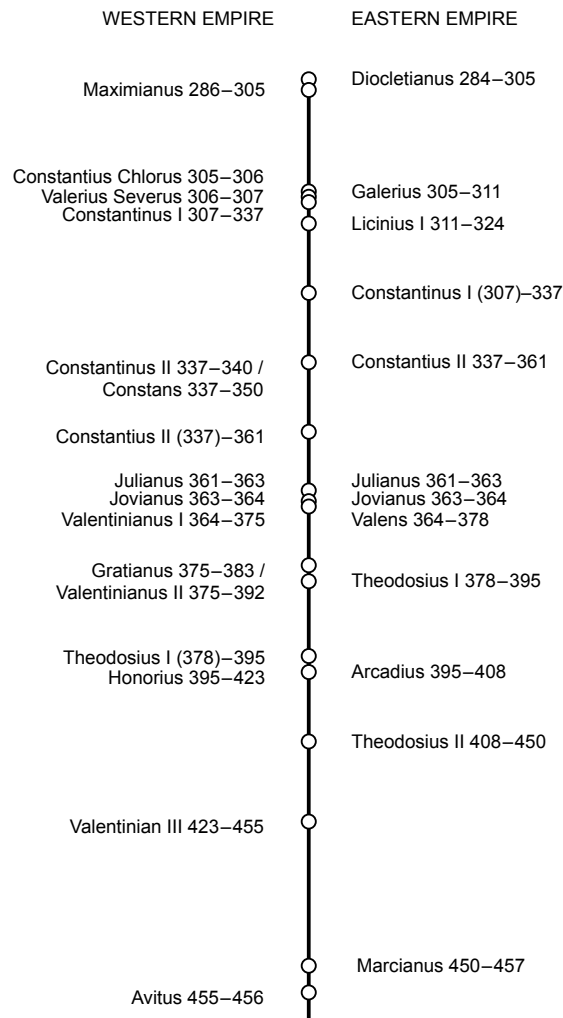


Fig. 2.39 Western and Eastern Roman Emperors' dates of reign.

western part of the town was cleared for the construction of a military post.

It is generally accepted that Diocletian (AD 284–305) and his co-emperor Maximian (AD 286–305) managed to stabilise the Empire (fig. 2.39). This was now divided into a western and an eastern part. Most provinces were subdivided to improve their manageability, and subsequently grouped into larger districts called *dioceses*. Lower Germany, renamed to *Germania secunda*, became part of the *diocesa Galliarum*. The historical sources of the Late Roman period mainly refer to *Gallia* instead of its constituent parts, which is a severe hindrance to our understanding of events on the Lower Rhine.

From the reigns of Diocletian and Maximian onwards the army and the military infrastructure were thoroughly reorganised, building on earlier experiments with a mobile field army in the rear of the frontier and fortified posts along the main roads into the hinterland. The frontier garrisons were thinned out and the remaining troops were accommodated in smaller forts with massive stone walls, numerous projecting towers and wide ditches. Existing forts were often considerably reduced in surface, and some were abandoned while a few new ones were added.

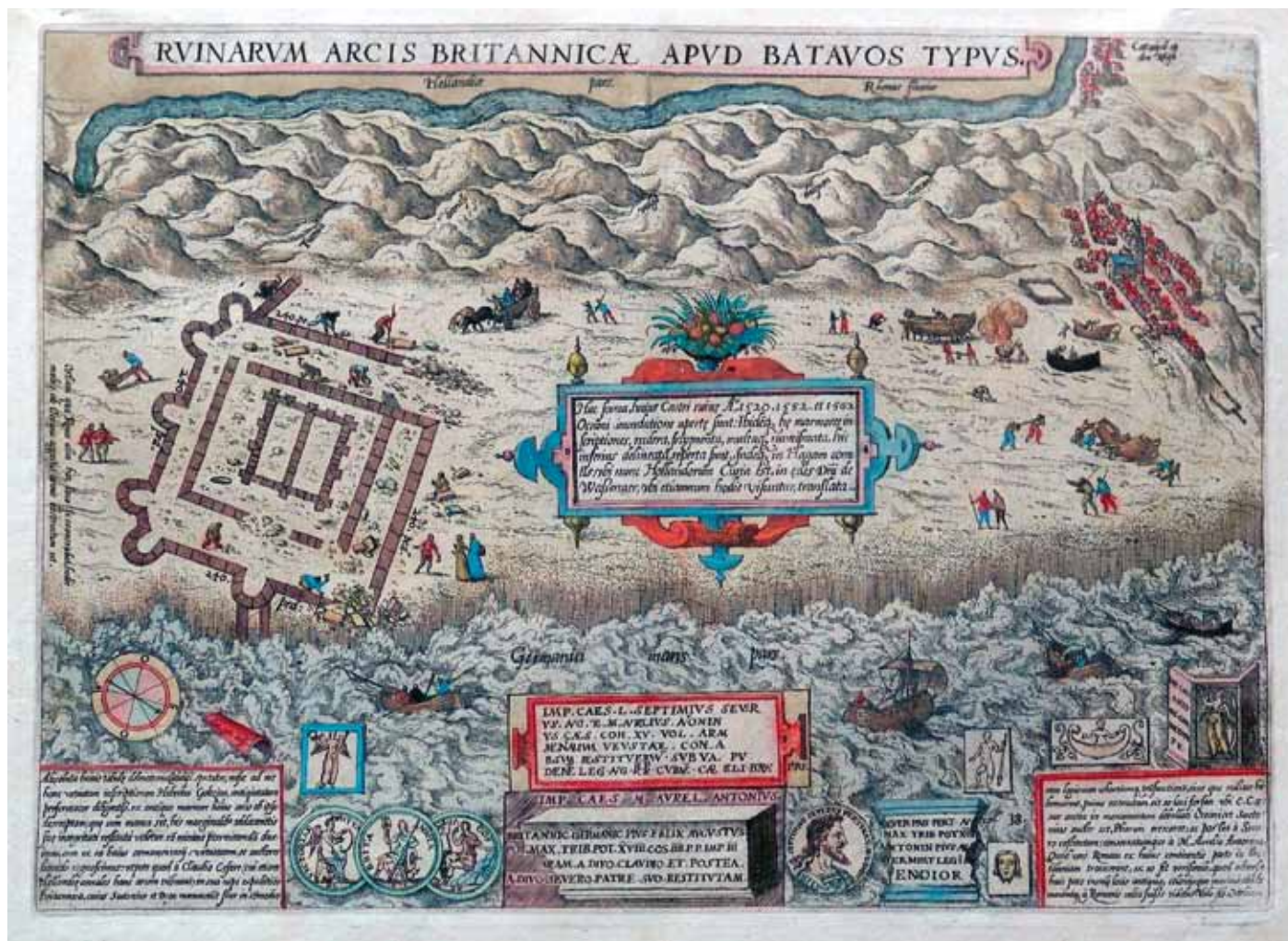


Fig. 2.40 Coloured engraving of the Brittenburg made by Abraham Ortelius in 1581 showing the remains of the westernmost fort of the Lower German Limes, as seen at very low tide in the 16th century.

Whether the frontier section downstream from Nijmegen continued in use is unclear, in the absence of attested remains of Late Roman walls and ditches. Because the late 4th and early 5th centuries seem to have been extremely wet – as reflected by a clear shift of rural settlements in the delta to more elevated positions – it cannot be ruled out that the fort sites were now considered as unsuitable, or that the region was no longer worth protecting. It is not very likely that the massive walls and deep ditches of Late Roman forts have been accidentally missed at all sites in question. The only site in the delta for which a Late Roman fort seems certain is the now submerged Brittenburg at Katwijk (fig. 2.40). However, rather than being the end point of a defence line along the river Rhine, this most likely belonged to a series of fortifications along the southern North Sea coast. The 4th and 5th centuries were characterised by numerous armed conflicts between emperors and usurpers, and by unrelenting Frankish attacks. During the more stable reigns of Constantine the Great (AD 306–337) and Valentinian (AD 364–375), many military installations on the Lower German frontier were built or rebuilt, like the bridgehead fort at Köln-Deutz ▶ 38 under Constantine and the massive tower

of Moers-Asberg ▶ 30 under Valentinian. The building activities reflect the Frankish invasions, some of which ended in the settlement of Frankish groups to the left of the Rhine in exchange for their employment as frontier garrisons. In the 5th century the military infrastructure along the Lower Rhine gradually collapsed through further troop reductions for the protection of Italy and ongoing Frankish invasions. When Köln was taken over by the Franks in the 450s AD, Roman rule of the Lower Rhine area finally ceased.

2.b.3 Later developments

The development of the landscape and of the remains of *Frontiers of the Roman Empire – The Lower German Limes* in the Middle Ages and Modern Period has not always been identical and simultaneous between Germany and the Netherlands. For this reason some of the later developments are discussed separately for the two countries.

MIDDLE AGES

Most of the military installations on the Lower Rhine were left to their fate in or after the Late Roman

period. Downstream from Nijmegen, the thin spread of Late Roman finds may indicate that evacuated fortifications were already being robbed, since there are no known traces of fort defences from this period. In an area without natural stone reserves abandoned forts were eagerly used as quarries. While this is not certain for the Late Roman period, it is well attested for the Early Middle Ages, when for instance the fort at Bunnik-Vechten ▶11 was dismantled to reuse the stones for church-building in nearby Utrecht. Judging by the rarity of substantial remains of stone walls most fortifications and other stone-built structures in the Dutch frontier zone shared the fate of Vechten. The forts of Utrecht-Domplein ▶10 and Nijmegen-Valkhof ▶14 became nuclei of Early Medieval development, but it is uncertain whether there was any continuity in occupation from the Late Roman period. At Nijmegen some of the walls of the Roman fort may have been reused in the *Kaiserpfalz* (royal palace) of Charlemagne (AD 742–814) and its presumed predecessors, and fragments of Roman pillars and other construction materials are still visible in the remains of chapels from successors to that palace. At Utrecht the Roman fort made way for a cluster of chapels, churches and palaces, and formed the core of the ecclesiastical territory. The governor's palace ▶37 in the capital of the province of Lower Germany remained a centre of political power after Late Roman times. The city continued to develop from the Middle Ages to the present day and the town hall is still located directly above the palace. At other major sites such as Xanten

▶27 and Bonn ▶41 the city centres moved away from the Roman military installations and developed in the areas of former Roman cemeteries or civil settlements. In the eastern river delta at least four forts fell victim to post-Roman river erosion. Until very recently, Herwen-De Bijland ▶19 was also considered as a completely eroded fort, on account of the occurrence of many stone remains and other finds at depths of 8–10 m in fossil river channels, but now we know that parts of two or more camps have escaped the brute power of shifting meanders. The fort of Arnhem-Meinerswijk ▶12 is another example, damaged by migrating meanders in the Late Roman period or Early Middle Ages and again in the Late Middle Ages. Finds assemblages similar to that of Herwen-De Bijland point to the existence of several other forts which appear to have been even less fortunate. Upstream from Xanten few sites were eroded by the river. It is still unknown exactly when the eastern parts of two military installations in Alpen-Drüpt ▶29 were eroded by a recent course of the Rhine. The fort of Haus Bürgel ▶35 is today located on the right bank of the Rhine. During the great flood of 1374, after which the river changed its bed – and thus Haus Bürgel changed its side of the Rhine – only the southwest corner was destroyed; a large proportion of the remaining parts of the building is now integrated into a castle complex. In the course of the Middle Ages nearly all the remains of the Roman frontier installations disappeared from sight, but the ruins of the Roman bridge over the river Erft were still visible in the 17th century (fig. 2.41). In



Fig. 2.41 Remains of the Roman bridge at Neuss-Grimlinghausen were to be seen until Early Modern times (drawing c. 1620/30).

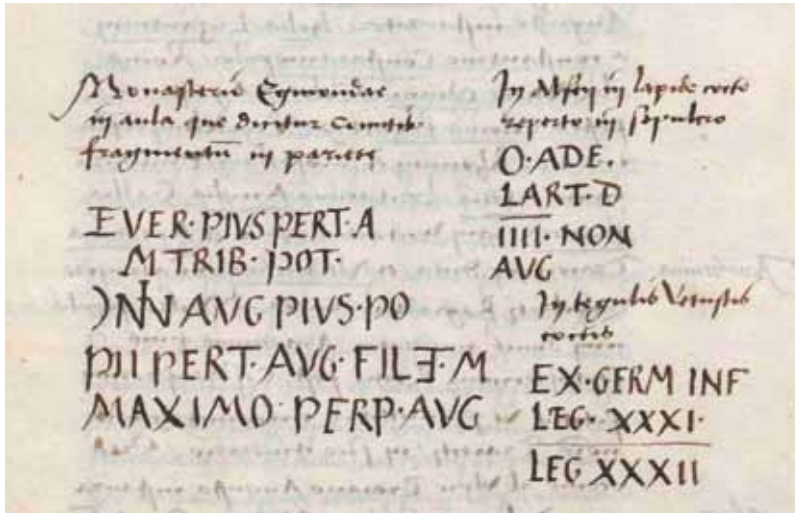


Fig. 2.42 Fragment from a manuscript of the *Historia Episcoporum Ultrajectensium* by Wilhelmus Heda, published c. 1520–1524. In the left part a now lost building inscription dateable to AD 200–204 is mentioned, which was probably found either at Katwijk-Brittenburg or at Leiden-Roomburg. Utrecht University Library ms. 0 b 6, 12 verso.

urban areas, forts and other structures were covered by increasing amounts of settlement waste and debris from demolished buildings, gradually building up protective levels. In rural areas some overgrown Roman remains were covered by manure and settlement waste, which provided some protection, but others were exposed to ploughing, and in a few cases to the extraction of clay and sand.

ANTIQUARIAN INTEREST

The Renaissance, which developed in Italy in the 14th century and spread to the rest of Europe by the 16th century, was characterised by a profound interest in Antiquity. ‘Above all, one must hasten to the sources themselves, that is, to the Greeks and ancients’, as the famous Dutch humanist Erasmus (1466–1536) stated, leading to a hunt for Roman inscriptions, coins and buildings.

Netherlands

Erasmus’ contemporary Cornelius Aurelius (c. 1460–1531) was perhaps the first to record Roman buildings and finds in the Rhine delta. He mentioned in 1502 the discovery of ‘foundations of a large palace’ and of three inscriptions at Leiden-Roomburg ►5, for which he cites the texts. The swift increase in antiquarian interest is illustrated by the staggering number of 978 coin collections which the renowned numismatist Hubertus Goltzius (1526–1583) boasted of having visited on his journey through Europe in 1558–1560. The rapidly spreading knowledge of Roman sites seems to have led to considerable activity in collecting Roman objects (fig. 2.42), judging by the lively account of a visit to the site of the Roman fort at Bunnik-Vechten ►11 in 1711: ‘I noticed several people roaming the fields, looking for silver and copper coins of Roman emperors, fragments of red jugs, tiles, old glass, rings and other things. [...] I even heard from these people

that recently such fragments had been carried off by the cartload, either to clear the fields, or – as I prefer to believe – to sort out the antiquities at leisure at home’.¹⁴

The early 19th century saw the gradual development of a more scientific approach to archaeological finds and remains. In the Netherlands a key role was played by Caspar Reuvers, who in 1818 was appointed as professor of archaeology at Leiden University and, at the same time, as the first director of the newly established National Museum of Antiquities, also at Leiden. Reuvers is famous for his excavations at the former estate of Arentsburg at Voorburg ►3, where he lived in 1827–1834. Here, he uncovered parts of the Roman town of *Forum Hadriani*, recording his findings in excellent drawings and plans. The National Museum would remain the leading excavating institution for much of the following century, although regional learned societies and universities gradually started excavating as well.

From the early 20th century onwards excavation methods improved, with increasing attention paid to connecting the unearthed buildings and other features with the associated coins, pottery and other finds. As excavating was manual work until well after the Second World War, the scale of the excavations was generally limited, and any stone walls uncovered were often left in place, reducing the damage to the archaeological remains. Strong population growth – from 5 to 8 million in 1900–1940 in the Netherlands – required an enlargement of towns and villages and an intensification of agriculture. Although this led to many new archaeological discoveries, for a long time excavations continued to be steered by scientific curiosity rather than by any policy of anticipating impacts of spatial developments. Without the personal efforts of local clergymen and dignitaries, most would have been lost.

Germany

In Germany, too, an increased interest in antiquity began in the 15th and 16th centuries. The rediscovery in Rome in 1455 of the historical and ethnographic study *Germania* of Tacitus and its subsequent printing, led to the first studies of the country’s ancient history. This return to antiquity, however, was a largely literary study, focusing on which sites of ancient ruins might correspond with places mentioned in the texts; targeted excavations were rare. The humanist Pighius (1520–1604), born in Kampen (NL) and died in Xanten (DE), succeeded for the first time in identifying *vetera castra*, known from literary sources, as Xanten. In *Asciburgium* (Moers-Asberg), too, the first recognition

¹⁴ Paraphrased from L. Smids, *Schatkamer der Nederlandsche oudheden* (Amsterdam 1774) 429–430.



Fig. 2.43 Roman finds and inscriptions incorporated in the facade ornamented the exedra-shaped open-air tomb of Johan Maurits, Prince of Nassau-Siegen (1604–1679) at Kleve. The finds have been replaced by reproductions in modern times.

and interest in the ruins as being Roman took place after 1521. The remains, seemingly still partly visible, found their way into cartographic works.

In the 17th century, the interest in archaeological artefacts and the number of collections and publications increased. Johan Maurits, Prince of Nassau-Siegen, began collecting inscriptions and placed them in outdoor antiquarian cabinets. In 1678 he had several of them, including the famous Caelius gravestone from *Vetera*, built into his open air tomb in a park (fig. 2.43). The inscriptions were moved to the newly founded museum in Bonn in 1820 and replaced in the park by reproductions. Another collection, created by the humanistically educated Graf Hermann von Manderscheid (1535–1604), consisted of finds from Köln and Bonn as well as monuments from the Jülich region, the Eifel and occasionally from further afield. The stone monuments were once set up in his castle courtyard; today many of them have been included in the collection of the Römisch-Germanisches Museum at Köln.

The ‘search for antiquities’ continued during the 19th century, but cannot yet be regarded as a developed science. Many historical and archaeological associations and new museums of cultural history were founded. Prior to the First World War, important steps were taken towards the establishment of an ordered approach to the preservation of historical monuments. The historical importance of the Rhineland was recognised, and the Museum für Vaterländische Alterthümer zu Bonn founded, at the comparatively early date of 1820. Already at that time, the goal was ‘the preservation and research of interesting fragments from Roman times’. At this time also, the first excavations in the area of the legionary fortress in Bonn took place. The members of the Verein von Altertumsfreunden im

Rheinland, which had existed since 1841, were active in exploring the Rhineland. The *Bonner Jahrbücher*, an important academic publication, is still published by this association today. In 1857, Alfred Rein wrote a book on sites and roads between Köln and *Burginatum* (Kalkar-Bornsches Feld), and can thus be regarded as the founder of systematic research into the Lower German Limes. With the founding of the Reichslimeskommission in 1892, systematic research of the Upper German-Raetian Limes began. The main initiator of the foundation was the ancient historian Theodor Mommsen, one of the most important antiquarian scholars of the 19th century.

At the end of the 19th and the beginning of the 20th centuries, various first scientific excavations of important sites took place, with the aim of researching and preserving the antiquities found there: e.g. Constantin Koenen (fig. 2.44) began excavating the legionary fortress at Neuss in 1887 and Hans Lehner began researching the site on the Fürstenberg near Xanten in 1905. Constantin Koenen was the first to establish the principles of archaeological research based on excavations. The most modern methods were used, including the first photo documentation of the excavation process. This research represents the beginning of modern provincial Roman archaeology. The excavations in the legionary fortresses of Bonn, Neuss and Xanten were crucial for the interpretation of the ground plans of Roman forts. This work on the legionary fortresses of the Lower German Limes, which have been particularly well researched, is of especial importance and continues to form an important basis for research today. The first excavations at the site of the only fleet base on the Lower German Limes began as early as the 1870s, during building construction.

Fig. 2.44 Constantin Koenen was one of the pioneers of Roman archaeology in the Rhineland and the first to conduct scientific excavations on the site of the legionary fortress of Neuss-Koenenlager ► 33.



MODERN ARCHAEOLOGY

The Second World War was in many ways a caesura in the development of archaeology. In some cases war damage offered an opportunity for excavation, but on the whole the post-war reconstruction and the need to feed the starving population led to development and agricultural exploitation at a scale and speed which exceeded by far capacity for excavation. The ‘Lust-

grabung’ (excavation steered by curiosity) of the past made way for the ‘Rettungsgrabung’ (emergency excavation).

The excavation of endangered archaeological sites was to some extent facilitated by mechanisation, with the introduction of draglines and other mechanical excavators. Narrow excavation trenches were replaced by area excavation, and stone walls could now be easily removed. At the same time, the quality of archaeological documentation improved significantly using a variety of technological developments. Alongside excavation drawings, photo documentation became a standard procedure and the spatial recording of the locations of excavations and of individual features became much more precise. From the late 1980s onwards, post-excavation analysis was increasingly facilitated through the use of computers, whilst various methods from the natural sciences were applied more widely to archaeological data, enabling, amongst other benefits, the broadening of the interpretational scope by providing precise dates and insights into the physical and natural landscape setting of the archaeological sites. Not less important was the introduction of such non-destructive research methods as aerial photography and geophysical survey, which reveal archaeological features without disturbing them.

Netherlands

The excavations in the 1940s at Valkenburg-Centrum ► 1 and Elst-Grote Kerk ► 13 were both initiated following near complete destruction of local churches by

Fig. 2.45 Grote Kerk at Elst ► 13 in 1948, heavily damaged by bombardments in 1944–1945. View from the northeast.





Fig. 2.46 Remains of the governor's palace in Köln ▶ 37 have been preserved underground and made accessible to the public.

bombing, while at Bunnik-Vechten ▶ 11 an excavation was made necessary by a need for soil improvement. These are telling examples of the direct effects of the Second World War (fig. 2.45).

A less direct effect was that of the large-scale redistribution of land to improve agricultural exploitation; this particularly affected the river area from the 1950s onwards. The redistribution was preceded by a large-scale coring survey, to assess the agricultural quality of the soils. An important side effect of this survey was the discovery of many archaeological sites, as the habitation layers were recognised in the core samples. Increasing awareness of the need for spatial planning can be recognised in the adoption of the first Spatial Planning Bill in 1960. By this bill and its successors, spatial development became much more 'predictable', thus providing time for prior archaeological research. At the same time, knowledge of past landscapes and habitation patterns improved through ongoing archaeological surveys and excavation campaigns, the scale of which increased through the 'landscape archaeology' trend of the 1970s. As a consequence of these developments, the presence of archaeology – that is: past habitation – became more 'predictable'. All in all, assessment of the archaeological impacts of spatial plans improved greatly, enabling destruction of archaeological remains to be avoided – at least theoretically.

Germany

War damage in Köln offered the opportunity to carry out large-scale excavations in the area of the Praetorium. In 1953, O. Doppelfeld uncovered the main building of the governor's palace, which was made accessible underground for the public (fig. 2.46).

The development of new settlements in the 1950s, 60s and 70s also led to Roman sites being built over. The

construction of single-family houses at Moers-Asberg ▶ 30 and Neuss ▶ 33 resulted in many small interventions that provide a good picture of the military installations without destroying much archaeological substance.

Special attention should be paid to the survey and non-destructive exploration of several monuments since c. 2005. The use of LiDAR (light detection and ranging), where the surface is illuminated with pulsed laser light, brought numerous new sites to light. Through the systematic analysis of LiDAR data, many new temporary camps have been discovered in forest areas near Xanten ▶ 25–26 and Bonn ▶ 40 and ▶ 42. Using the magnetometer geophysical survey technique, the spatial organisation of military complexes at new ▶ 22 and previously known sites ▶ 24 and ▶ 28 were completely surveyed. The surveys produced extensive new results; their scientific interpretation profoundly changed the picture of the quality and quantity of Roman building projects and their effects on the cultural landscape of the time. Even with the well-known archaeological research method of aerial photography, new military installations are continually being discovered. Most recently this was done at Kleve-Keeken ▶ 20, where a camp with two ditches now forms a counterpart to the newly discovered camps at Herwen-De Bijland ▶ 19 for securing the Rhine-Waal bifurcation. Through systematic, combinatory evaluation of the various survey methods, it can be predicted that new monuments will be discovered in the future and that their environment and spatial context will be better understood (fig. 2.47).

INTRODUCTION OF LEGAL PROTECTION AND ANCHORING IN SPATIAL PLANNING

From the late 1960s onwards the preservation of archaeological sites acquired a legal basis, through the

Fig. 2.47 Structures of the fort at Kalkar-Bornsches Feld ▶ 24 reveal themselves as crop-marks in this aerial photograph. The combination of different survey methods, such as aerial photography, geophysics or LiDAR, are very likely to lead to the discovery of sites yet unknown.



promulgation of state laws (DE) and a national law (NL) for the protection of archaeological heritage. These laws were introduced in 1961 in the Netherlands, in 1978 in Rhineland-Palatinate, and in 1980 in North Rhine-Westphalia (cf. chapter 5). In the Netherlands, the sites of several Roman forts and associated elements were legally protected between 1969 and 1983. In Germany, the registration of well-known monuments took place in the 1980s; for newly discovered monuments the process is underway, and is strongly supported by all stakeholders.

The 'Valletta convention', short for the 'Convention for the Protection of the Archaeological Heritage of Europe (revised)', adopted in Valletta (Malta) in 1992, constituted an important further step towards the preservation of archaeological heritage. It replaced an earlier convention of 1969, which was targeted mainly at preventing illegal excavation. The Valletta convention is aimed at preventing any form of excava-

tion, by reconciling and combining the requirements of archaeology and development plans. The adoption of the principles of the convention in state and national legislation has undoubtedly contributed to the sustained protection of many remains of the Lower German Limes.

RECONSTRUCTION AND PRESENTATION AS PROTECTIVE INSTRUMENTS

The lack of visibility of the buried remains of the Lower German Limes has always made it difficult to promote awareness of their presence and importance. In the 1970s this problem was tackled on an ad hoc basis by re-constructing excavated features on the modern surface, such as the ground plan of the headquarters building of the fort at Zwammerdam (not included in this nomination), which was marked by excavated stone blocks. This approach



Fig. 2.48 The course of the defensive wall of the fort of Utrecht-Domplein ► 10 is indicated by a band of weathering steel, into which the outlines of several sections of the Roman frontier have been engraved. When dark at night, light is projected from below while a fine water spray is projected upwards, creating the impression of a vertical line.

was not pursued systematically, and never extended to reconstructing buildings up to their projected original form and dimensions.

Over the past two decades the urge to visualise the remains of Roman forts and other elements of the frontier has increased, along with development pressure. Particularly in urban areas, space is scarce. Safeguarding areas from building and other types of development requires broad societal support, which can be created and fed by making buried remains more

widely known, understood and appreciated. To further a sense of connection and relevance, it is preferable that visualisations have additional functions that benefit local communities. Visualisations can not only offer protection in a horizontal sense, against developments in the surrounding area, but also in a vertical sense, by literally covering the buried remains. Damage to the underlying remains is prevented by applying a protective layer of soil and by avoiding penetrating foundations (fig. 2.48).

3 Justification for Inscription

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